SCIENTIFIC AMERICAN

A Weekly Review of Progress in

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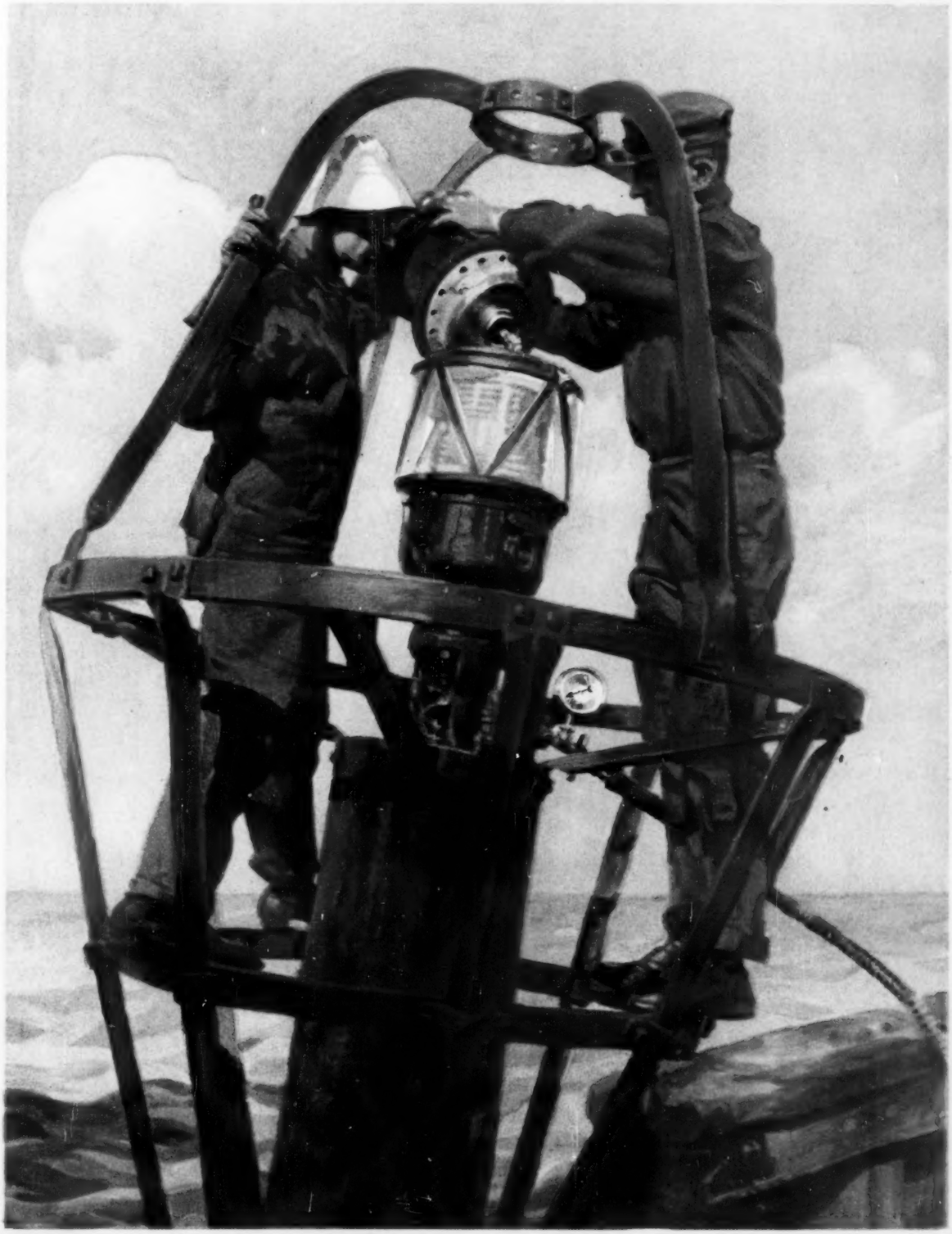

LIGHTHOUSE SERVICE MEN RECHARGING A GAS BUOY AT SEA—[See page 582]

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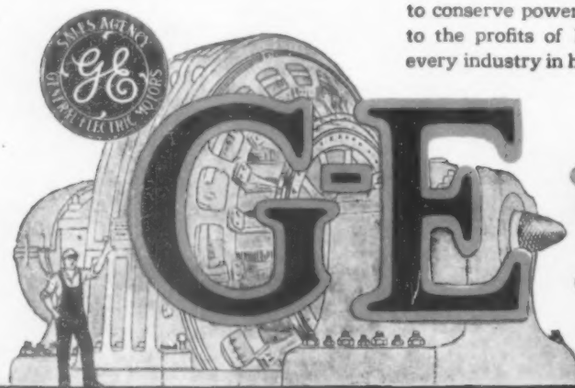

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SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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Underground mining mill, with mountain side broken away to show the details of construction

First Underground Mining Mill in America

By W. F. Wilcox

A MINING company operating its mine above timberline in Ouray County, in the heart of one of Colorado's greatest gold deposits, is completing the first underground mining mill in America, and doubtless the first in the world.

At these great altitudes in which most of the gold mining companies of Colorado are obliged to operate, tremendous bodies of snow have to be reckoned with in winter. Mine buildings and mills erected at great cost are often swept away without a moment's warning and many lives lost by the immense avalanches of snow let loose far up on the peaks, which bury the buildings under thousands of tons of snow or sweep them like playthings into the canyons below. So the mill has been taken from the surface altogether, and put in the one safe place—inside the mine itself, wholly beneath the ground.

The maintenance of a reduction mill on the surface in the vicinity of the mine would be practically impossible, hence the company devised what is claimed to be the first wholly underground reduction mining mill on this continent. The company in the past has met with such heavy losses from destructive slides that it appeared to be but a matter of suspension of activities during the winter or a storage of ore until spring. However the problem has been solved and the mine will be enabled to operate both mine and mill the year round in so far as weather conditions are concerned. The mill, which is of fifty tons daily capacity, is expected to cost approximately $7,000.

The mill is located off a heading, a little more than one thousand feet back from the mouth of the cross-cut tunnel and at a vertical depth of 650 feet. Here a raise is made vertically 112 feet from the tunnel level, with a sump 10 feet in depth below the tunnel level. At another point 1,000 feet back from the mouth or portal of the tunnel, an incline is made that connects with the raise 65 feet above the tunnel level. From this point of connection, the ore bin room, crusher room, ball mill room, roughing table room, flotation tank room, pilot room and filter room are excavated on either side and in successive steps down the incline, thus completing the several processes necessary to bring about the reduction of the ore. The ore is elevated from the tunnel level to the crude ore bin at the top of the incline by an electric hoist at the top of the raise, and passes downward through the mill by gravity.

Doubtless other mining companies operating in regions often visited by destructive snow slides will follow the example of this Colorado company, if ever their present properties are unfortunate enough to be destroyed by slides.

It is interesting to note that this underground mill employs the latest process for separating values—that of oil flotation—which is being installed in many mills today.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Around the World in Three Days?

IF Jules Verne stretched imagination to the breaking point in his fascinating story, "Around the World in Eighty Days," what shall be said of Brigadier-General William Mitchell's suggestion that some day it may be possible to attain speeds which, if they could be maintained, would carry us around the world in three days? In the course of a very powerful appeal at the Flying Club, New York, on behalf of the bills now before Congress for the formation of an independent Air Department of the Government, the General referred to the good work which has been done by the engineering section of the Air Service since the armistice. Reference was made to the turbo-booster, which makes it possible to deliver additional air to the carburetor at great altitudes, and to the variable-pitch propeller. An ordinary airplane using the booster has already ascended with a passenger over 30,000 feet, and General Mitchell is convinced that within a comparatively short time an altitude of 40,000 to 50,000 feet will be obtained.

Now at that height of eight to nine miles, the extreme rarity of the atmosphere involves a corresponding decrease in resistance to the flight of an airplane, and, of course, a decreased amount of oxygen in a given volume of air. An oxygen respirator would supply the pilot, a turbo-booster the engine, and sufficient reaction against the tenuous atmosphere would be obtained by the use of the variable-pitch propeller.

General Mitchell, who was commander of the air service in the American Expeditionary Forces, tells us just what will be the result of these up-to-date combinations: "It seems probable, therefore, that by the use of the variable-pitch propeller, which can be set for the maximum climb to get to these high altitudes, and after the altitude has been arrived at, can be changed so as to give the maximum amount of horizontal speed, the swiftness of locomotion of airplanes at a high altitude will be greatly assisted because of the lessened resistance of the air. It seems probable that speeds of from 300 to 400 miles an hour may be expected." This, it may be remarked, would allow an airplane to cross the Atlantic in six or seven hours and to make the trip around the world in three days, provided that the apparently insuperable problem of fuel supply could be overcome. Astounding as these figures are, he would be a bold prophet who attempted to set a time limit to the accomplishment of this altitude and speed. Developments in aviation have been going forward at such an ever-accelerating rate, that it is conceivable we are even now merely at the threshold of accomplishment.

This look into the future by the General came at the close of an address to a gathering of flying men in which he made a strong plea for concentration and not dispersion of our aviation activities in this country. He urged that the more simple and more direct the control over all branches of aviation by a single Air Department, the more efficient will be its development. If we do not thus concentrate our efforts, then the War Department, the Navy Department, the Post-office Department, the Treasury Department, the Department of Commerce, the Coast Guard, the Geodetic and Geological Surveys, the Public Health Service, and all sorts of other organizations will create their own separate air services. The result will be that so many and so divergent views will be presented to Congress as to these Departments' several necessities, as to make Congress even more bewildered over the air proposition than it is at the present time.

The Uses of the Navy

VERY shortly it will be necessary to determine how great a Navy we now require, what proportion of it shall be maintained in active commission, and where its active fleet shall be based. The late war has so completely changed the old political and strategical conditions that it seems absolutely necessary for the naval powers to get together and determine just what shall be the relative strength of their fleets and what their best disposition in the various oceans. This fundamental question might well become a matter for mutual international discussion and amicable arrangement. In view of this fact, we have a feeling that the recent splitting up of our main fleet into two halves of approximately equal strength, and basing them upon the opposite coasts of a continent, where they are 5,000 miles apart by water is a decidedly premature step.

But judged on its own merits, quite apart from the question of the pending Treaty and League, the voice of history and the common consensus of present day naval opinion is against such a move. Not dispersion, but concentration should be the order of the day.

The uses to which a navy can be applied are: the denial of the sea to the enemy in time of war; protection of our own merchant shipping; the keeping open of the sea for our own uses; the protection of ourselves against invasion by sea; and, after we have secured the command of the sea, the transferring of troops by water to the different theaters of war.

Now, it will be evident that if the naval forces of the country are to be in a position to perform at any time the above specified requirements, it is fundamental that these naval forces must be at all times *strategically* concentrated. This does not imply that the ships must all be assembled in one port, but rather that they shall be so disposed as to prevent any considerable force being cut off by the enemy. An illustration of what is meant by "strategical concentration" was afforded by the British Grand Fleet, which maintained its main force of battleships off the north of Scotland, although its battle-cruisers were based in the south of Scotland—for it was possible for these two forces to effect a junction at any time, in spite of any effort of the enemy to prevent it, the German bases at the Kiel Canal and at Wilhelmshaven being at such a distance from the British coast, that there would be ample time for the battleship and the cruiser fleet to effect a junction before the German fleet could attack either one of them separately.

Considering the groups of different types of warships, it will be seen that large battle-cruisers, because of their speed and endurance, can be based almost anywhere beyond a certain striking distance from the enemy, and still be strategically concentrated with the main fleet. Likewise, the fast, light cruisers and destroyers may be placed with considerable freedom and still be strategically concentrated. Submarines, owing to their special qualities of small visibility on the surface and complete invisibility below, and also because of their very wide radius of action, especially in the later and larger types, may be placed anywhere without fear of being cut off by the enemy.

But when we come to the slow and heavy battleships and auxiliaries, it is evident that great care must be taken to dispose these ships so as to avoid the possibility of their being intercepted and overwhelmed by an enemy that appears in strong force. Furthermore, aside from the necessity of concentrating heavy ships, it is most desirable to keep as many of our large vessels together in one fleet as practicable, in order that officers may gain, during peace, the experience necessary to handle large naval forces in time of war. Concentration of naval forces greatly increases the competitive spirit and develops tactics, signals, et cetera, and, indeed, improves the efficiency of the whole organization.

It has been urged that the opening of the Panama Canal has brought the Atlantic and the Pacific together and made them strategically one. It is true that one of the strongest arguments from the naval side in favor of cutting the Canal was the object lesson afforded by the battleship "Oregon," which, during the Spanish war, had to steam 14,000 miles around Cape Horn in order to reach the theater of war in the Caribbean. We doubt, however, whether the most enthusiastic naval advocate of building the Canal ever contemplated the separation of our main battleship fleet into two halves of equal strength, and basing them permanently 5,000 miles apart. It is certain that today, at any rate, the great majority of naval opinion is unfavorable to the breaking up of our Atlantic fleet, with its resultant loss of efficiency and greatly increased cost of operation.

Inventions to Order

IT were a platitude to say again that America is a nation of inventors. It may not be out of place, however, to point out that there are two kinds of invention, and that in both we excel. There is first the man who invents because he loves to do so and cannot help doing so. Application of his work may come in time to reward him, or may be deferred until after he has exhausted the allotted span of life; but other people worry more over this than he does himself. Even our great commercial laboratories encourage the men who work in them to pursue inquiries out of sheer interest in the subject involved, though the possibility of finding in the business direct use for the results seems remote or indeed non-existent.

But at the same time we have the pot-boiling inventor, the man who looks carefully about for a need to manifest itself, and then sets deliberately to work to meet it. Lest the adjective which we have here applied seem a derogatory one, we hasten to add that the inventor of this type is an eminently useful member of society. If we must descend to examples, we have them in plenty in connection with the war, where Army and Navy repeatedly said, "We want a device that will do thus and so"—and in remarkably short order got it. Or we may cite the California association of walnut growers, which offered a set prize for a machine that would brand walnuts without breaking the large ones or missing the small ones, without exceeding a fixed cost of construction and another fixed cost of operation, without falling below a fixed rate of turning out the work, and subject to numerous other awkward restrictions—and which got literally thousands of responses, so that its only trouble lay in picking the machine that went furthest beyond the minimum requirements that had been laid down.

Perhaps it is the success which met this venture into the field of invention-to-order, that has inspired another group of business men to take a similar flier. This time it is the fur merchants of New York; and all they require is a machine, implement, or process which will so mark skins and other furs that substitution of other skins or furs therefor will be impracticable, and that identification thereof will not be lost through all the harsh steps of dressing, dyeing and manufacturing. It appears that the people who conduct these steps have been borrowing ideas from the goldsmith of Syracuse, who introduced a silver stuffing in the solid gold crown which his imperial master had ordered him to repair. And American inventors are now called upon to play the rôle of Archimedes, who informed the tyrant that the substitution could be revealed by weighing the crown in water to learn whether its weight and volume matched up with the supposition that it were still of solid gold, or whether it would be thus shown to contain an air space.

It is a rather imposing task which the fur men have set before American inventors; but we have little doubt that the ingenuity which has been responsible for more of the world's development than we care to catalog will be able to meet the demand—and incidentally, to earn the $2,500 offered for the solution to the puzzle.

Automobile

Fewer Horses in New York.—Figures just published by the Sanitary Bureau of the Department of Health of New York City show that for the period from March, 1917, to the present time there was a decrease of 2,664 occupied horse stables in the city, with a decrease of 32,000 in the number of horses. The census taken this year shows the number of horses now in the city to be about 75,000.

Ignition System Parts.—Keep close watch of secondary distributor head of magneto or coil system as this is where considerable ignition trouble frequently starts. Accumulations of carbon or metallic dust create a path for the passage of current and must be wiped off from time to time with a cloth dipped in gasoline. If in doubt as to whether a spark plug is good or defective, try the following test: Exchange suspected plug with that from a live cylinder and run the engine. If the trouble is cured it follows that the plug is at fault. If it remains in the same cylinder the plug is not at fault.

Delivering a Building by Truck.—The development of motor truck transportation is shown in the recent delivery at Milwaukee of an all-steel building, 90 by 80 feet. This was made by a Youngstown, Ohio, plant on order of a large automobile manufacturer and as it was urgently needed, motor trucks were used to expedite delivery. The building, in parts, was transported on two large trucks in three days, much faster than would have been possible by freight; besides, two handlings of the material were saved as it was possible to load the material on the trucks at the plant and unload it at the building site.

Simple Mixture Insures Clear Vision.—To maintain a clear vision through the windshield in rainy weather when the glass usually clouds up is vitally important to the safety of the motor car and its occupants. A variety of rubber wipers that scrape off the accumulated moisture are used to keep the glass clear in wet weather, but many believe that the old fashioned alcohol and glycerin solution, which is carried in a small bottle and rubbed on the glass as needed is best. If the bottle containing the mixture is wrapped in a cloth and stored away in the side pocket it will always be ready for use and a cloth to apply it will also be handy when needed.

Stabilized Fuel Prices.—While gasoline prices have increased steadily during the last five years, in line with crude oil, the advance has been relatively much smaller than in crude, showing effect of stabilizing of gasoline prices by the government in 1916 and indicating that gasoline at present prices is far below what could be expected. Figures issued by geological survey show a marketed production of crude oil in the United States in 1918 of 355,000,000 barrels against 341,000,000 barrels in 1917. The output of gasoline in 1918 increased in proportion, but the demand for gasoline has increased in even greater ratio. If gasoline prices had gone up to a degree proportionate with advances in crude oil it is stated the New York price would be 39 cents and the Chicago price about 33 cents a gallon. The New York price is now about 24½ cents, tank wagon basis, and Chicago 21 cents.

Taking Air from Crankcase.—In various classes of engines using liquid fuels especially when employed for stationary power, part or all of the primary air supply to the carburetor first passes through the engine crankcase. The object of this is to prevent the formation of mixtures that are explosive in the engine base such as would result from unvaporized liquid leaking back past the rings from the combustion chamber and being gradually vaporized by the heat of the crankcase. This practice might be followed to advantage in connection with automobile engines as the passage of cool air through the engine base would keep the lubricant cooler and would undoubtedly pick up some of the combustible gas produced by the evaporation of the fuel drippings and the lighter constituents of the lubricating oil. This would seem to offer advantages if heavier fuels, such as kerosene or distillate are used for power. This might also prevent the thinning out of the sump oil because of its dilution with the unvaporized constituents of the low gravity fuels used today in internal combustion vehicles.

Astronomy

Astronomy in British Schools.—An Education Committee of the British Astronomical Association, consisting mainly of schoolmasters, is endeavoring to encourage the teaching of astronomy in British schools. A plan has been adopted whereby schools may affiliate with the Association at moderate expense, thus obtaining the *Journal*, the loan of lantern slides and other privileges. The Association is preparing a special series of lantern-slides for educational purposes.

Meteor Observations in Great Britain.—Mr. W. F. Denning, the veteran British authority on meteors, reports to the Royal Astronomical Society of Canada that during the years 1886 to 1918, inclusive, the real paths of 1,065 fireballs and shooting stars were computed under his direction. Three catalogs, containing 788 of these, have been published in the *Monthly Notices* of the R.A.S. The long duration of certain radiants from the same apparent points in the sky and the displacement from night to night of various periodical showers, such as the Perseids and Lyrids, have been well corroborated by the results obtained.

A Photographic Study of the Great Nebula in Orion has been in progress at the Lowell Observatory since 1911, where more than 100 photographs of this object have been made with the 40-inch reflector. A report by C. O. Lampland states that great care has been taken to make the negatives in as uniform a manner as possible in order that the plates of each series, for different epochs, may be suitable for intercomparison. The photographs are made primarily for the examination of nebulous detail for possible variations in position, form and brightness, and examinations have been made with a Zeiss comparator equipped with a monocular blink-microscope. No change in nebular details has yet been positively established, but a number of interesting observations have been made on variable stars in this region.

Astronomical Telegrams.—The Central International Bureau for Astronomical Telegrams has been established at Uccle, Belgium, by the newly organized International Astronomical Union. Uccle, which is a suburb of Brussels, is the site of the Royal Observatory of Belgium. Harvard College Observatory has announced that it will coöperate with the new bureau, as it previously did with the corresponding institution at Kiel. Subscribers to the Harvard telegrams will telegraph their announcements to Harvard, whence they will be cabled abroad and also distributed to subscribers in this country. Cablegrams received from Europe will be transmitted to subscribers at the actual cost of the inland telegram. The bulletin service of the observatory, by which printed announcements of telegraphic information are distributed by mail, will be continued.

Lunar "Vegetation."—Prof. W. H. Pickering's ideas regarding conditions on the moon are now widely familiar, yet the conservative astronomer still experiences something of a shock when lunar "vegetation" is mentioned. In a recent number of *Popular Astronomy* Prof. Pickering presents a number of lunar drawings made with a telescope of only three inches aperture, power 90, to illustrate the fact that an instrument of this modest size enables one to watch the progress of interesting phenomena on our satellite. The drawings are of the crater Eratosthenes. This crater closely resembles its larger neighbor, Copernicus, when the sun first rises upon it, but, says Prof. Pickering, as the lunation progresses Copernicus turns white, from precipitated cloud and snow, while Eratosthenes turns dark, from the growth of vegetation within and around it. Lunar vegetation, he adds, is not green, but gray like our sage brush and certain cacti, and black, like some of our lichens—almost a purplish black in some places near the equator. The lunar vegetation is scattered, generally in rather small patches, over the surface, and none is found near the poles. The only greenish spot is on the floor of the great crater Grimaldi, but even here the color is not marked. Most of the lunar surface appears to be merely a desert waste. "The vegetation, where found, is often associated with minute craterlets, as in Alphonsus, the craterlet occurring at or near the center of the dark area. Sometimes it is associated with rills, as in Atlas."

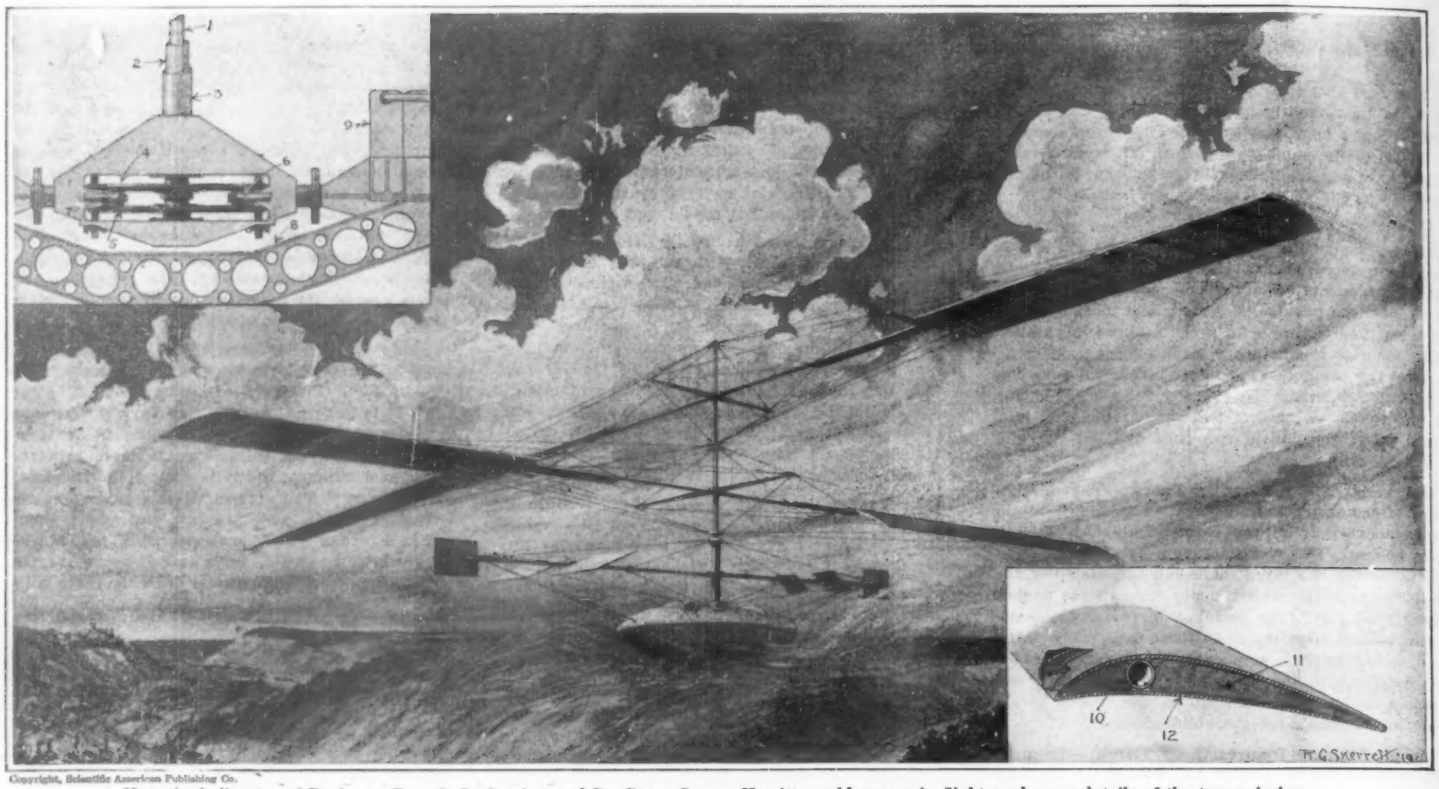
Electricity

Washing Carpets Electrically.—A newly-developed electrical carpet washer makes possible the washing of carpets without taking them off the floor. In fact, two hours after the machine has been passed over the carpet the latter is ready for use. No water touches the rug or carpet. Instead, a warm "sudsy" cleaning compound is scrubbed down to the bottom of the nap so as to clean every fiber thoroughly and take out all dirt or grit. Two brushes, made of soft, yielding rubber, are oscillated by an electric motor 500 times a minute, thus, the maker declares, duplicating the scrubbing motion of the human hand. The soap compound which is used by the carpet washer is said to contain no harmful chemicals or animal fats.

Steering Ships by Electric Cable.—There is much promise in a new electrical device which has been invented by Earl C. Hanson of Los Angeles, Cal., and which has been turned over to the Navy Department. The device and the methods of application are comparatively simple. A suitable cable is laid in the ship channel through which is sent a low-frequency electric current. The current in this cable actuates devices on the ship, which in turn set up a peculiar sound in a pair of telephone receivers. This sound indicates when the vessel is directly over the cable. Any variation in the course away from the cable is indicated by the visible indicators that show in feet the distance away from the cable. Two cables can be laid so as to take care of incoming and outgoing shipping. The sound on each cable is different, and there can be no confusion. Along the cable at certain intervals a short section is insulated with lead. Through such sections no sound can come and therefore the man on listening duty can tell instantly how far the ship has progressed.

Wireless in Wartime Germany.—It now appears that Germany just about kept pace with the other belligerents in the matter of radio communication in the recent war. It was found possible to keep up communication in both directions between Germany and the colonies for at least six hours a day, the best time being from 6 to 11 a. m., and the best wave-length, 5,500 meters. The Goldschmidt machine at Eilvese gave much trouble and failed for long periods; nevertheless, toward the end of the war, as a result of certain improvements, it became more reliable. Its capacity was increased to 800 kilowatts. The Nauen station, also with 800-kilowatt capacity, was most satisfactory in its operation. Methods of double sending by two transmitters acting on one antenna tuned simultaneously to two wave-lengths have the advantage of attaining a greater degree of selectivity by the combination of the wave-lengths. New types of cathode tube amplifiers rendered communication possible between firing trenches with light apparatus. Blocking stations were very successfully used to interrupt the wireless communications of enemy aircraft. Directive stations were employed in aiding Zeppelins over Paris through thick fog.

Neon Vapor Lamps.—Previous endeavors to manufacture metal filament lamps which could give 10 candle-power or even less, and operating on the 220-volt lines generally used in many European countries, have been a failure in that the strength of the filaments has been found to be very low. A satisfactory solution of this problem is claimed to have been arrived at by two scientists working in the Pintsch laboratories in Berlin. The lamp designed by them, according to *Electrical Review*, can be manufactured for a current consumption of only 1 to 5 watts and can be connected to any 220-volt network. It is provided with an ordinary lamp bulb and a standard base, and contains in a clear glass bulb a mixture of neon and helium gas at 8 to 10 mm. pressure. In this bulb is a large surface cathode, and, opposite it, an anode, placed at such a distance that at 120 volts pressure a dim discharge is set up which forms the luminous yield of the lamp. The remainder of the voltage is absorbed by a series resistance, the size of which is arranged to suit the current absorbed by the lamp. This resistance is concealed in the lamp socket. In order to change the color of the light given from orange red to pinkish white, a little mercury vapor can be added to the gas charge.



How the helicopter of Professor Francis B. Crocker and Dr. Peter Cooper Hewitt would appear in flight, and some details of the transmission and the revolving wings

Again the Helicopter?

Experiments by Prominent Inventors Who Hope to Realize This Long-Standing Dream

By Robert G. Skerrett

TO one familiar with the art of mechanical flight, it is an old story that the airplane propeller is a relatively inefficient instrument of propulsion—that a very large percentage of the power delivered by the engines is lost simply because the screw fails to get a good hold upon the air. To make matters worse, this "slip" grows in geometric ratio as the speed of revolution mounts higher and higher. Therefore, to provide the needful measure of sustentation, the flying machine's wings are given more and more surface in order to utilize the buoyant reactions of the atmosphere; for the wings are relatively much better able to play their part in keeping the craft aloft than is the propeller, as it exists in general service.

The basic reasons for the screw's handicap are its moderate size, its rotary velocity, and the elastic nature of the medium in which it works. Airplane propellers, according to the catalogs, are built to make anywhere from 1,200 to more than 2,000 revolutions a minute, and they vary in size from 5 feet to about 10 feet in diameter. When going at their designed speeds, these screws send rearward a column of violently disturbed air, and, what is more to the point, they set up pronounced perturbations over a considerable area in the air ahead. Therefore, the propeller moves forward into a medium upon which its grip is discounted by the extent of this agitation; the larger the number of revolutions a minute the greater is this hampering factor. On the other hand, the airplane's wing surfaces meet the impinging air under far more favorable circumstances, and the reactions thus induced are in the main of a buoyant or lifting nature in effect. Thanks to the revelations of the wind tunnel, aeronautical experts have been able to design wing forms of an extremely efficient character which, for every square foot of surface, provide a remarkable amount of sustention. But this solution invokes an increase of wing-speed with every increase of power and capacity; and as the size of the airplane increases, the problem grows apace of effecting a safe landing and of getting off the ground without mishap. The giant plane's very bulk and weight invite hazards, especially if the craft be forced to the ground after dark or be obliged to come to earth where a suitable stretch of cleared and fairly smooth country is not available.

If we were to assert unqualifiedly that a promising alternative for the airplane, and one which presents hope of eventually overcoming the drawbacks enumerated, lay in the helicopter, we should probably—and justly—be greeted with shouts of derision. "What, that old chestnut!" our critics would exclaim. "Why, that has been exploded more times than we can count." Well, so it has; current opinion with regard to the helicopter, the machine that goes straight up by boring a hole in the air, is so unflattering that many an aviation expert would hesitate to have his name linked with the effort to make it practicable. But sometimes wise men rush in where fools fear to tread. And the bald fact which we have to chronicle is that two no less notable engineers than Peter Cooper Hewitt and Francis Bacon Crocker have produced a helicopter which has developed a lift of 4,000 pounds with motors of 200 horse-power.

AS Mr. Skerrett says in his introductory remarks, it would be a bold spirit who would claim that the helicopter, that much ridiculed scientific freak, is a practicable means of flight. But in the age when humans fly at all, in the age of wireless and the X-ray and the apparent verification of the Einstein theories, it would be an even more rash citizen who would assert with equal positiveness that the helicopter is inherently absurd and incapable of serious development. At any rate, with true modern spirit, two eminent engineers have set out to see what they can make of the aerial corkscrew. The article tells us of the line their experiments have taken, and of the degree to which they are inclined to claim success.—THE EDITOR.

The machine was assembled and put through its paces at Ampere, New Jersey, last year. It was called into being as a possible aid in fighting the Teutons, and the cessation of hostilities stopped further trials for the time; but before the tests were concluded it was amply demonstrated that a helicopter had been produced of a unique form which might come to stand in a class distinct from those machines of an allied type which had proved so disappointing. Doctor Hewitt and Professor Crocker accomplished their ends by breaking away from the lines of endeavor previously pursued by engineers and inventors. In particular they appear to have produced propellers of a far more efficient order than any airplane screws now on the market. Indeed, this may rightly be said to have been the key to their attacks upon the problem.

The airplane propeller that develops a lift or thrust of 10 pounds per horse-power on a fast machine is the exception rather than the rule, and a very large number of them do not give more than 6 or 7 pounds per engine horse-power. This would not do, of course, in a helicopter, where lift and sustention must be secured by the thrust of the screws alone. The primary object of the research was to obtain propellers that would give a thrust of not less than 12 to 15 pounds for fast machines and anywhere from 20 to 40 pounds per horse-power for practical weight-carrying helicopters. The propellers finally produced gave a lift of 2,550 pounds for 126.5 horse-power when making but 70 revolutions a minute! That is, the thrust was at the rate of 20.2 pounds per horse-power.

The machine was deliberately overweighted so that it could not rise—the problem of landing again being one it was desired for the present to avoid. Had it been free to ascend it must have done so, because the thrust obtained was nearly 300 pounds in excess of the total weight of the helicopter itself. The measure of the lift was established by carefully calibrated platform scales; and readings of the thrust at different speeds of rotation and varying driving powers were indicated on a large-faced dial. For the time being, airplane engines were replaced by two electric motors each of 100 horse-power. These were used not only to permit experimental speeds from the very lowest and on up gradually to the higher rotary velocities, but likewise to

enable the investigators to check up by the electric meters the power consumed at any moment.

The propellers employed had diameters of 51 feet; were mounted one above the other upon concentric shafts; and, being respectively right-and-left handed screws, were revolved in opposite directions. They were placed vertically 7 feet apart so that the effectiveness of the lower wheel, working in the wake of the upper one, was as little affected as practicable by the disturbance set up in the air. Operating in this manner, the propellers alone exert a strong stabilizing force.

Because of the great diameter of the screws, it is possible to obtain the needful peripheral speed when they are driven at a relatively low angular velocity, and the blades are able to work upon a large mass of air without setting up the violent perturbations which characterize the reactions provoked by the usual types of airplane propellers. Therefore, it is practicable to use blades that act upon the air much after the manner of airplane wings. As M. Gustave Eiffel has made clear, by his memorable work in his laboratory at Auteuil, the vacuum created at the back of an airplane wing is much the larger factor in the total lift impulse produced. Accordingly, the desire was to take advantage of this phenomenon in designing the blades for the two propellers with which the helicopter was equipped. The blades were made of an aeroform model, 30 inches wide and about 15 feet long, and they were secured to the outer portions of tubular steel arms each 25½ feet in length. This caused the blades to follow paths where their impact with the air would be most effective.

By attaching the blades to the supporting arms forward of the center of pressure, the arms, instead of pushing the blades through the air, thus draw them onward. This arrangement obviates the risk of "chattering," and, by introducing a measure of elasticity, allows the blades, within some limits to adjust their pitch angle automatically and to accommodate themselves to changing atmospheric stresses. The blades are built up of aluminum partitions placed transversely, and are then sheathed upon their upper and lower surfaces with the same material. This construction provides the desired degree of strength and, incidentally, makes them fireproof. It will be observed that the blades are placed at a distance from the propeller hub, so to speak, and in this way is avoided that mass of material which characterizes the usual airplane screw just where the speed of revolution is too low to produce a commensurate or helpful measure of thrust. Manifestly, these helicopter propellers are remarkably light judged by their effectiveness, and yet are strong enough to meet all service requirements.

Having elected to adapt the aeroform wing to propellers of especially large diameters and low angular velocity, the next problem attacked was that of devising means by which the efficient, high-speed airplane engine could be utilized as a prime mover. This meant that a suitable reducing gear would have to be interposed, and it was equally plain that the gear should have the dual characteristics of positiveness of contact and flexibility to meet the changing stresses

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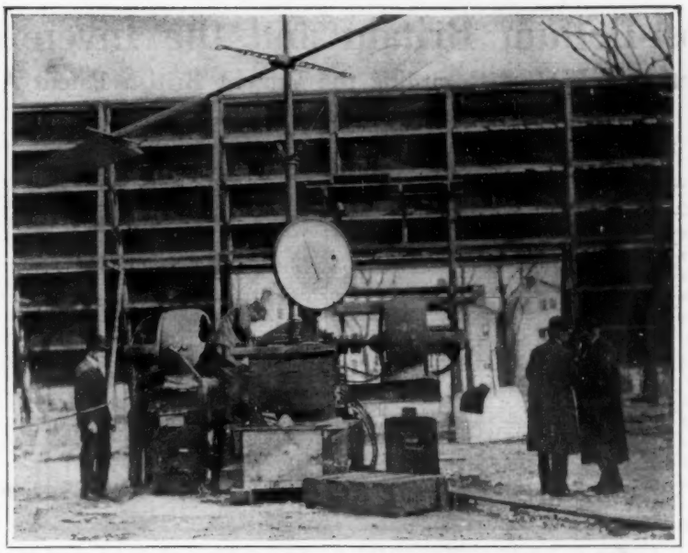
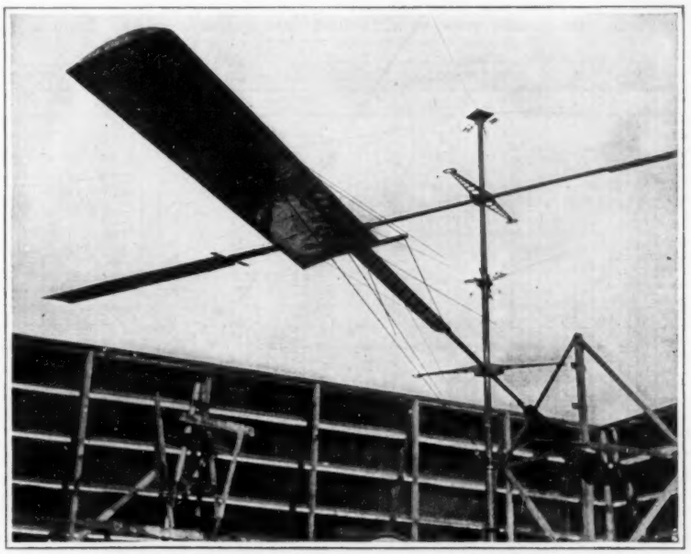


Two electric motors used to drive the helicopter, and the lift indicator



View of the central shaft and one of the revolving wings

Steam Locomotive and Passenger Coach Combined

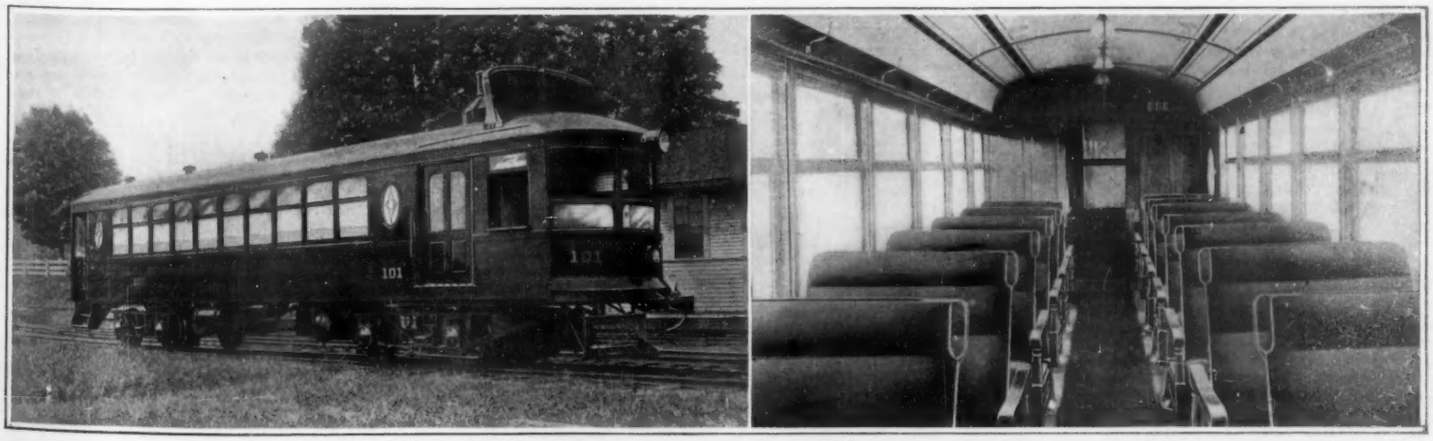
THIS is the old story about necessity being the Mother of Invention but the invention, in this case, is decidedly new, and that is why we are telling the story here. The story opens up with two brothers, F. E. and F. O. Stanley, who owned lands and a large hotel near Denver, Colorado, and found that while there was a railroad to their property, the transportation was not adequate and it was certainly anything but attractive and comfortable.

These brothers have for years been identified with the development of the steam automobile; and so it did not take them long to build a larger engine than that used in their pleasure car. This engine they installed in what is known as the "mountain wagon." This wagon carried several passengers and while entirely satisfactory for the purpose intended, it could hardly take the place of the railroad which will always be the accepted method of land travel when distance combined with comfort is the paramount consideration.

However, the "mountain wagon" attracted the attention of one of the officials of a big trunk line railroad in the West. This official convinced the Stanleys that there are innumerable places where railroad transportation is needed but cannot be made profitable when a train consisting of a locomotive and coaches must be hauled to carry the light traffic. Nor can the roads afford to electrify in order to haul a single-car train. The power houses, overhead or third-rail construction, rail bonds, and so on, represent an investment that is entirely out of reach.

And in this manner the steam unit car shown in the two accompanying illustrations, was developed. A car was built and put in service on a road in New England. The first boiler installed was a fire tube boiler. This was changed to a water tube boiler of very rugged construction. This car, which operated for something over two years, proved so successful and showed such promise that it attracted the attention of a large firm in Boston, which later took over the unit car for manufacture and marketing.

The car is propelled by a modified twin cylinder engine mounted on and forming part of the forward truck, power being transmitted direct to the axle by a spur gear, the engine and driving gear running in an oil bath in an oil-tight case. The power developed (approximately 60 horse-power) is about one-third of that developed by the average locomotive which hauls a dozen or more coaches, and when periods of emergency exist, such as starting on heavy grades, bucking snowdrifts, or making up time, the plant is capable of developing 180 horse-power to meet these conditions. An improved water tube boiler is mounted in the forward end of the car, supplying steam at a working pressure of from 700 to 1,000 pounds.



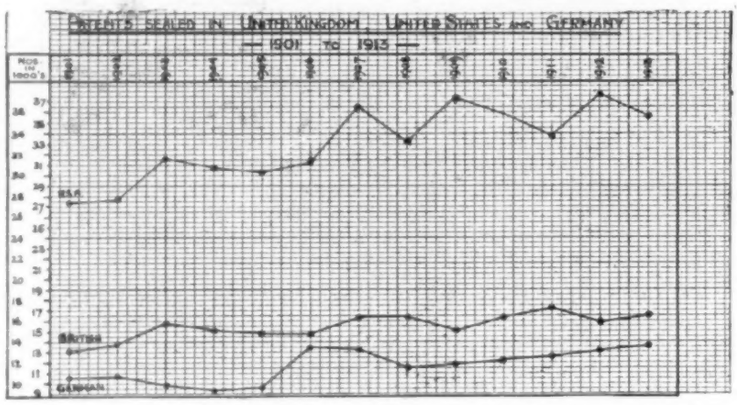
Steam unit car which has been designed for traffic on branch lines, and a view down the passenger compartment

Post-Bellum Britain and the Inventor

Some Facts and Figures Regarding the Present British Patent Activities

By Sir George Croydon Marks, M.P.

THOSE who are now disturbed concerning the outlook for the advancement of the world's industries against the trend of ruthless labor agitations that are not of any particular national but rather of international growth, may gather some hope as to the ultimate stabilizing result of this after-the-war trouble by taking the long and broad view that the British Parliament has evidenced in its care for fostering and developing the new spirit that is alive in Great Britain, for the introduction of new industries and the adoption of the best modern methods in the manufacturing and industrial life of that country.



Total number of patents granted by the government patent offices of the United States, Great Britain and Germany, 1901—1913

Following upon the disbandment of the enormous number of newly created and admirably equipped works that were erected all over England to produce munitions and all that was demanded for the national well-being and safety of the British Empire, there has arisen a demand that is wellnigh universal for such newly equipped works to be taken over by individuals or by the State, for the production of machinery and the manufacture of implements, articles of necessity and food, hitherto only obtainable from overseas or through enemy trading sources.

Many sales of huge works have been made by the Government Disposal Department to private persons and British firms, who have secured such with the announced intention of either starting upon entirely new ventures or developing the manufacture of devices and articles that they had never been previously interested in other than as buyers or users.

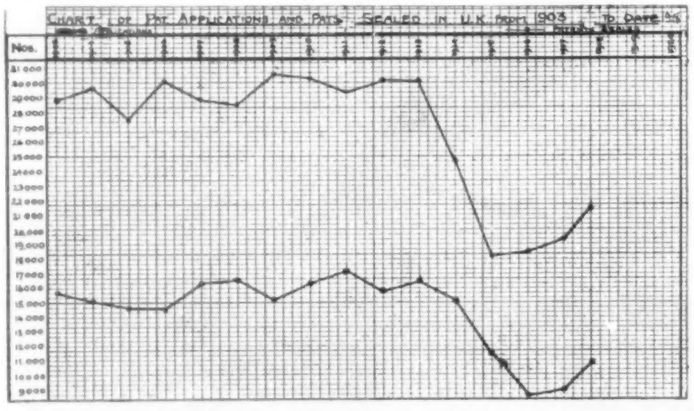
This new spirit is shown to be of a practical nature by the prices that have been paid for the taking over of such works as are immediately capable of being remodelled or easily adapted to the fresh industrial ventures that have been decided upon by those who have learned, as some of the lessons of war, that increasing national manufacture and greater output from industries must be secured, to enable the ravages and inroads of war losses to be provided for, in order that some of the world's demands for manufactures that have been arrested or checked for five years may be secured for the owners of the newly created British works and the awakened spirit of enterprise now alive in all those associated with British industries.

The records of the British Patent Office show that more applications are received for British patents from resident inventors in Great Britain than are received by the patent offices in any country in the world from a like or equal population, so that the degree of inventiveness of the Britisher is not and cannot have been at fault nor the British patent system a hindrance to enterprise but the old lethargy and indifference of the British manufacturer have alone stood in the way of Britain resuming and taking a forward or leading movement in the development of many of the world's great industries.

This indifference has been entirely changed by the experiences of the war and the national difficulties that have arisen, so that today inventors are welcomed and many British patents are becoming of increasing value where previously they had been contemptuously ignored by those who had been approached as presumably interested in the improvements and developments that were submitted to them.

This awakened spirit of recognition has been appreciated by the British Government and translated into their recently introduced new British Patents and Trade Mark Bills which the House of Commons enthusiastically received and passed by giving to them, in an unexampled manner, third and final reading without either debate, discussion or division. The members of the House itself were fully satisfied with that detailed consideration given to such measures by the committee to which they had been referred.

These new bills will make for the betterment and the greater value of all British patents now actually in existence and of all those to be hereafter granted to British residents or foreigners, after the bills have passed the House of Lords so as then to become operative at the beginning of next year.



Fluctuations in the total number of applications for British patents filed and sealed from 1903 to 1918. (Upper line—applications; lower line, patents sealed)

Under the new Patents Bill all existing British patents will be given an extra two years' life without further taxes being demanded, while all new patents will be granted for sixteen instead of fourteen years as at present.

With a view to assist those inventors who are unable themselves to carry their invention into effect and to obtain, for them manufacturers, so as to encourage their adoption and thereby secure that new inventions shall so far as possible be worked on a commercial scale in the United Kingdom without undue delay, the old working requirements have been cancelled and a free advertisement given to every patentee, who at any time wishes to grant a license to a manufacturer to work or use his invention on a royalty basis.

Under these new proposals, when a patentee thus notifies the British Patent Office that he desires to grant a license, the offer will be advertised free of expense to the applicant and the patent will be endorsed with the words "License of Right," and thereafter all renewal fees that will be payable annually after the expiration of six years will be reduced by one-half, so that the patentee in addition to obtaining the assistance of the Government to get his invention adopted obtains a remission of half the renewal fees that will be payable by any other person in England or any other patentee who does not desire to grant a license but elects to work it himself.

The annual fees that are at present payable upon all British patents commence at the end of the fourth year, the first such renewal fee being £5, and an increasing amount of £1 per year is demanded until the final or fourteenth year a fee of £14 is payable. Under the new law no fee will be payable until the end of the sixth year instead of the fourth year as at present and the fees thereafter payable will commence at £5 a year and end with £14 unless licenses are granted under the system due to the advertising "Licenses of Rights," when the fees will be one-half of the ordinary stipulated amounts.

If the patentee is unable to grant a license to an applicant except upon terms which the applicant may consider unreasonable, the Patent Office will undertake to act as the tribunal without cost to the applicant, to consider and adjust the same, the Comptroller, however, being required when deciding the question of any license to award such terms as shall secure to the patentee the maximum royalty compatible with the licensee working the invention within the United Kingdom on a commercial scale and at a reasonable profit. Should there be but one license only granted, he will require that there shall be guaranteed to the patentee a minimum yearly sum by way of royalty, and that the maximum royalty shall be payable in reference to all articles manufactured or used in connection with the patented invention.

One feature that has been objectionable in reference to all British patent litigation in the past has been entirely removed under the proposals of the new law, in that where at the present time any British patent that is the subject of litigation must have each and every one of its claims sustained, even though the patentee in an infringement suit may only allege infringement in reference to certain specified claims. Under the new law, in future the patentee will only be required to defend and sustain the validity of the claim against which infringement is alleged and the existence of other claims that may be invalid will not prejudice or nullify the suit upon which he has entered.

The manner in which the fluctuating industrial conditions and the distraction caused by varying national events affect the inventive efforts of the citizens of

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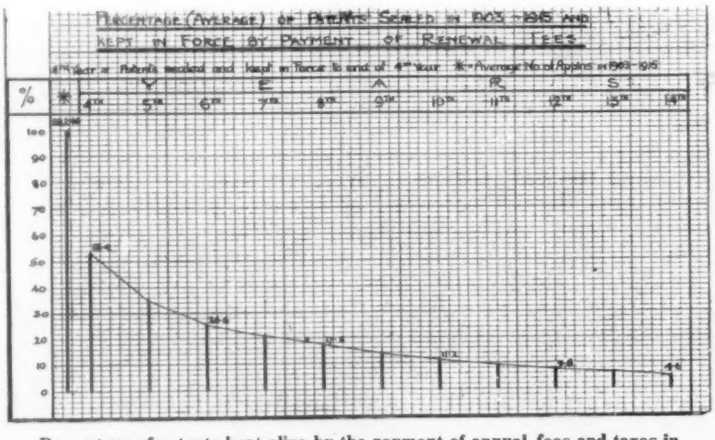


Percentage of patents kept alive by the payment of annual fees and taxes in Great Britain

Making a Plant Tie Itself Into a Knot

GEOTROPISM is defined as the property which plants or their organs manifest in assuming a definite direction with reference to gravity.

This tropism or turning toward the earth is clearly shown in the accompanying photograph. Two pieces of plain glass each four by five inches were taken as a basis upon which to build a simple germinator. On one glass, pieces of blotting paper were placed so that they barely touched the edge of the glass. Over these a frame of cardboard was adjusted to keep the upper glass from crushing the seeds placed upon the blotting paper. The blotting paper was thoroughly moistened with water, the seeds arranged, and covered with the second glass. The entire germinator was bound firmly together with tire tape to ensure that the experiment takes place within the limits intended to be imposed upon it.

It was not long before the seeds began to sprout and as the germinator was placed on one edge as soon as completed the root grew earthward. When the root had attained a growth of a little over half an inch the whole contrivance was turned through an angle of ninety degrees and allowed to remain for one day undisturbed. This process was continued until the root had come to its point of starting as revealed by the photograph. When the circuit was completed secondary roots had developed in addition to the root hairs found on the primary root.

The upper row of seeds were those of radish while the lower one was selected from mustard. All that germinated give evidence of "geotropism." The seed to the left did not germinate but formed a center for the growth of mold.

If the photograph is revolved in the direction of the arrows the response of the roots of the radish to gravity is at once apparent.—*Edmund Cocks.*

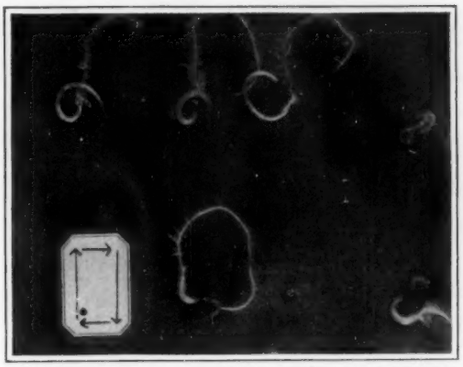
Horse Collars of Steel

A NEW kind of horse collar of steel instead of leather has come into use in France. The demand for harness has been enormous during the past few months and it continues to be very heavy in the Northern Departments of France. All the available harness has been sold at good prices, and there continues to be a dearth, on account of the shortage of leather; but although several thousands of horse collars are still wanted, buyers refuse to pay the prices quoted, while the manufacturers say that so long as the price of leather remains as it is they cannot accept less. Attention is, therefore, being given to pressed steel collars, which were imported before the war in fairly large quantities, and as there appears to be considerable economy in their use certain Paris firms are beginning to make the article to meet the demand in the liberated districts. The initial cost of manufacture is heavy, owing to the need of expensive tools, but this appears to be fully justified by the demand. Lightness and cheapness are points in favor of the steel collar.

Robbing the Mosquito of Her Breeding Places

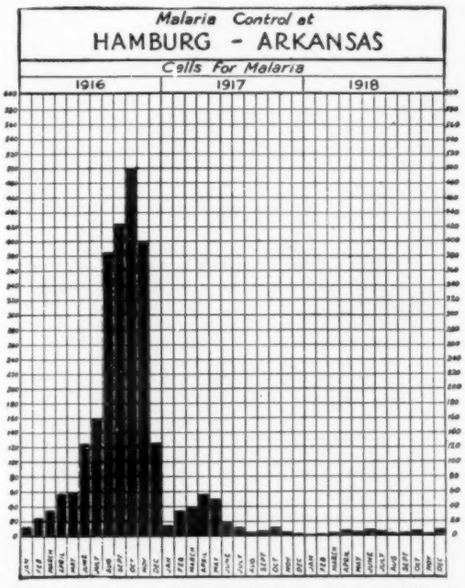
THE doctor knows that with proper authority and necessary tools he can check malaria, and the intelligent layman knows this too. Nevertheless, it is pleasing to the doctor and very comforting to the layman to have an exhibit presented showing the extent to which the ravages of this disease, no less serious in its effects because seldom fatal, can be controlled. As a matter of fact, the problem is a race and national one rather than one of individual health; for the ultimate effects of general malarial infection are as seen in the Mississippi valley regions where the scourge is heavy, a general lowering of the tone and a general descent into the pit of laziness and no-account-ness on the part of the entire community. Where except in a malaria-ridden district would one expect to find a civilized community which submits each spring to being driven out of its homes and compelled to subsist on charity for weeks at a time, only to move right back into the same old shacks as soon as the water level recedes below the doorsteps?

Arkansas and Mississippi are among the southern states which are right now taking strenuous steps to avoid the fate which befell ancient Greece—for historians are coming now to agree that the glory that was Athens and Sparta was dimmed because the malarial germ reduced the citizenry to the level of "white trash." As an example of what thoroughgoing drainage can do in the elimination of the mosquito, the record made in Hamburg, Ark., is especially illuminating. The work was put under way late in 1916, and was carried on with the idea of making the survival of mosquitoes through the season of 1917 difficult, and through 1918 well-nigh impossible. As a measure of the success met, a careful record was kept by all the town's physicians of all calls to treat malaria. The diagram presented herewith shows, in a way that appeals vividly to the eye, just what happened.

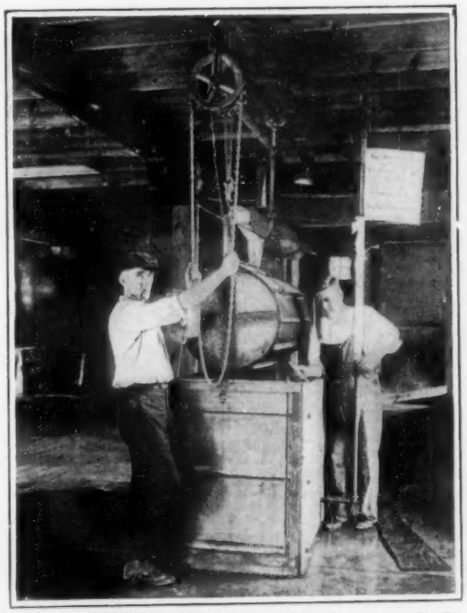


An interesting experiment showing how seeds germinate with relation to the earth

In October, 1916, these doctors were called out on malaria cases 500 times. For no month of 1917 were there more than 60 such calls. This in itself would constitute a notable improvement; but of course it is far from indicating mosquito eradication. But throughout 1918, after the work was well under way toward completion—and in fact after the middle of 1917, when the early crop of mosquitoes which had not succumbed to the first attacks had come and gone—the number of malaria calls for a single month was never in excess of ten. Doubtless some if not most of these were from chronic and persistent cases hanging over from the period when it was accepted that everybody had to have "feven 'n ague" as a normal incident of existence. But without considering this possibility the results are startling enough, and demonstrate clearly the efficacy of mosquito control. The community that suffers from chronic malaria is clearly, on the face of this showing, the community that chooses so to suffer.



What mosquito eradication did to the doctor's bills of one community



Special machine for immersing wheat in a warm bath

Warm Bath for Wheat

ONE of the most serious problems in the history of American agriculture has been solved by an Indiana man, Russell G. East of Shelby County. He did nothing more than many mechanically-minded men could have done, but he did it at the psychological time to remedy a condition which cannot be termed less than deplorable.

A few years ago smut was damaging the wheat crop and causing a loss of ten to twenty-five per cent in the yield. A field with enough straw to produce twenty bushels to the acre would fall far short of this average when it underwent the acid test of the weigher on a threshing outfit. Money that would have gone into the pockets of farmers was kept out by this insidious enemy.

Warm baths to eradicate smut were first used upon wheat by a Norwegian named Jensen. He was the father of the process which he announced to the world a quarter of a century ago. It would kill both the loose and stinking smut but was so slow that only a third of a bushel could be purified at a time; for this very sufficient reason the experts promptly ridiculed it into obscurity.

Necessity is still the mother of invention. When East with two helpers demonstrated the half-forgotten system of the Norwegian to a group of interested farmers and followed it up several months later by taking them into the plot where this grain had been sown, the men, noting the absence of the usual black heads, asked to have their own seed wheat treated. The county agent then remembered that he and his assistants had spent a whole day in renovating four bushels; and he realized that unless he could improve on this his achievement would be absolutely nothing.

How could the Jensen process be made practical? It must be made practical or a large number of Shelby county's farmers would be disappointed and forced to sow the smut-infected wheat. East immediately tackled the problem. Soon he had worked out a way whereby the golden grain could be purified fifteen times as rapidly as with the original method which had been shelved because it was palpably inefficient.

The pots and kettles of the old were discarded for the new process with its cylindrical drum of galvanized metal, a chain hoist and track, a wooden tank, and steam piped in from a traction engine. The screen-covered drum holds five bushels and is rotated by means of a chain and sprockets. With East's mechanism a hundred bushels can be treated in a single day whereas four was the limit of the method as introduced by the Scandinavian.

When a farmer brings to East wheat which he wishes purified, the filled sacks are dumped into tanks of cold water and left there four hours. Then the grain is dumped into the cylinder which is revolved in a large wooden tank for one minute in water with a temperature of 120 degrees. The cylinder is then withdrawn while steam is let in and the temperature of the water pushed up to 129 degrees; this warmth is maintained while the wheat takes a second bath ten minutes in length. The grain is spread on a cement floor to dry as the farmers rarely wait for it to dry thoroughly. The swollen condition of the seed necessitates the use of the oats side of the drill so the proper amount will be placed in the soil.

This central wheat-treating station in the Hamilton garage at Shelbyville, Indiana, is the first of its kind in the United States. The Department of Agriculture at Washington speedily learned of East's accomplishment, sent investigators and obtained all the information available. Stations are now being established in all the wheat-producing sections of the country.

The formaldehyde treatment, familiar to many farmers, is effective against stinking smut but loose smut which spoils the inside or interior of the grain and makes it unfit for flour cannot be killed unless the hot-water method is employed. East's device, superior to any ever used, gives the world more food and the growers more dollars.—*Carol C. Crain.*

The Romance of Invention—V

Some Notes on the Lifework and Character of a Great Chemist

By C. H. Claudy

TO the man in the street an "invention" usually means a machine, a piece of mechanism, on the levers and springs and wheels of which the inventor may obtain a patent which he may sell or upon the use of which he may obtain a royalty. Rarely does he think of "invention" in terms of "discovery" or consider that the scientist who "invents" with a test tube, a retort, some chemical symbols and calculations of formulae, can obtain patents upon his chemical processes or products and form an industry as well as he who "invents" a linotype, a typewriter, a harvesting machine or a calculating engine.

Yet some of the greatest and most important industries of America are founded upon chemical discovery, which is no less invention that it is not made in a forge or turned out on a lathe.

Thus, the metal aluminum was known for its strength and lightness long before it was a metal of commerce. Not until Charles M. Hall uncovered his simple process for extracting the metal from aluminum did we know the metal in the arts. His process is the basis on which the great aluminum industry rests. Castner produced a simple process for making sodium a commercial metal and simplified the production of some of its important compounds. E. G. Acheson discovered carborundum in 1892; three years later he produced artificial graphite and in 1906 "deflocculated graphite"—the enormous carborundum and graphite industries sprang from these inventions. The name of T. L. Wilson may not be familiar to many readers, yet any who have used acetylene gas are in a position to know what he did, for the carbide industry was developed to exploit his processes.

Chemical research which results in processes and products like these is often more truly "invention" than the ratiocination which results in a mechanical device. For the latter frequently springs forth almost perfect from the inventor's brain; the other may take years of patient laboratory work to bring it to full perfection. And not infrequently the commercially profitable chemical process or product involves in its production investigations which add largely to our knowledge of the science of chemistry, thus benefiting the world not only with the result but with the means.

In selecting the work of Dr. L. I. Baekeland as typical of chemical research and its results in the commercial world, no thought of invidious comparison with other great chemists and their products is in mind. But because Dr. Baekeland's work has affected so many industries and because he has been able to devote himself to several lines of research because of commercial success in a totally different line, it seems as if he, perhaps, better typified the opportunity and the romance of chemical "invention" than any other living man.

Every amateur photographer in the world has heard of, and almost all of them use, velox paper. It seems odd, today, to think that when it was first invented, public and manufacturer alike would have none of it. Yet, like many other good things, it had its way to make, meeting opposition largely because it was new and different and finally forcing itself on public attention from sheer merit.

Velox paper was Dr. Baekeland's first large contribution to modern industry, and on it, and the money it made him, he has founded his further and even more important researches. "I bought my independence when I was thirty-five years of age," says Dr. Baekeland, "with velox paper." What he is too modest to say is what he has done with his independence and the money velox brought him.

A word as to Dr. Baekeland himself. He was born in Belgium (Ghent) in 1863, entered the University at seventeen, took his B.S. and his D.Sc. before he was twenty-one (!) passing his examinations with the highest honors attained by any of the class of which he was the youngest student. He attained so many honors in his early scholastic career that a catalog of them would almost be wearisome . . . assistant and associate professorships at the University, professorship of chemistry and physics at the Government Normal school in Bruges, a traveling scholarship in chemistry won in competition, are included in the list.

Dr. Baekeland was an enthusiastic amateur photographer from the earliest days of that fascinating hobby. When he came to the United States, he first accepted a position as chemist in a photographic supply factory. But the work was too cramping for a mind that had to branch out or starve and in a couple of years he resigned and set up for himself as a consulting research chemist. In 1893 he formed a company with Mr. Leonard Jacobit which manufactured photographic papers . . . among them velox. Velox was the first of the very sensitive photographic papers . . . artificial light papers . . . which was insensitive enough to be handled outside the dark room. It is interesting to note that Dr. Baekeland committed what has been called a "photographic heresy" in the production of this paper, in that he omitted from the manufacturing process the washing which has always been thought necessary in the making of bromide of silver papers. But this omission in the chloride of silver emulsion with which he was working produced that very insensitiveness to feeble light which has made the familiar D.O.P. (developing out paper) so great an asset in the amateur and professional photography of today.

It took several years' hard work, however, before the paper made its way, but make it it finally did, and in 1899 the Eastman interests acquired Dr. Baekeland's company, and he was free from commercial worry, and in a position to devote himself at once to the work he loved best . . . the laboratory and its possibility of discovery.

Turning his attention to electro-chemistry, in which he has always been interested, he spent a winter in Berlin at the Technological Institution, after which he returned to found a small private laboratory near Yonkers and go to work. With Townsend, inventor of the electrolytic cell for the production of caustic soda and chlorine from salt, he worked out on a commercial scale the processes which resulted in a vast electro-chemical company at Niagara Falls with which he is still connected as an advisor, and in which work he took out his first two patents. It is interesting to note that Dr. Baekeland today has but a hazy idea as to how many patents he has taken out.

When Dr. Baekeland was the recipient of the Perkin medal, Dr. Elon H. Hooker spoke amusingly of some of the early Townsend and Baekeland experiments. Among other things he recounted this: "Imagine a wing of the Edison power station in Brooklyn. Two full-sized Townsend cells, erected with necessary supply tanks, exhaust chimney, etc., producing chlorine in juxtaposition to the valuable generating units of the Edison Company. Upon these the lighting and transportation conveniences of the 'city where we sleep' are dependent.

"Picture three young men, who did not know chlorine gas from attar of roses, or caustic from lemon ice, but of undoubted bravery, assisted by negroes whose only aim was Saturday night's pay and the hope of a possible bleaching—picture them, guided sporadically by Townsend but presided over, their drooping spirits revived, and their hope of heaven determined, by the genius of Baekeland. He, you understand, had just been rescued from the depths of photographic invention with its spirit-dulling materialistic opulence, and uplifted to the rare delights of electrolytic research—that shadowy borderland between pure science and commercialized industry where mathematics and chemistry join hands in the great unknown.

"Here our friend held forth long hours in shirt-sleeved efficiency, while his social reputation became tainted, his domestic status strained and his short nights of peace in Yonkers were rent with agonized appeals for help from Brooklyn at three o'clock in the morning: 'Cell No. 1 has broken down; the place is full of chlorine gas; we are all out in the street, the Edison boss says his $100,000 generators are being eaten by a green substance. What shall we do?' Answer, punctured with picturesque speech: 'Start it up, of course. I will be over before breakfast.'

"Or again: 'Cover cell No. 2 has blown off from hydrogen pressure. What would you do?' Answer, in voice choked with sleep, or deep emotion, and clothed in pajamas: 'Put on a new cover and have a darkie sit on it until I can get over in the morning.'"

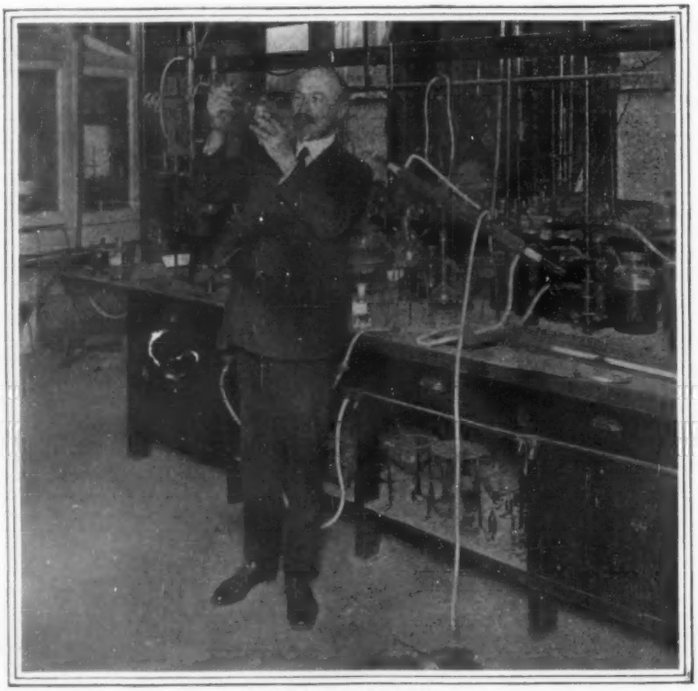
By all of which it will be seen that there is plenty of foundation for the reputation which Dr. Baekeland bears among his friends of having a sense of humor.

Had Dr. Baekeland been content to stop where he was, he would still have clear claims to fame as a chemist and as an inventor and producer of new processes, founding new industries. But Baekeland had just got himself fairly started. His next and what is generally conceded to be his greatest piece of work is that which bears his name (American spelling). For bakelite has made a very large and very secure place for itself in many

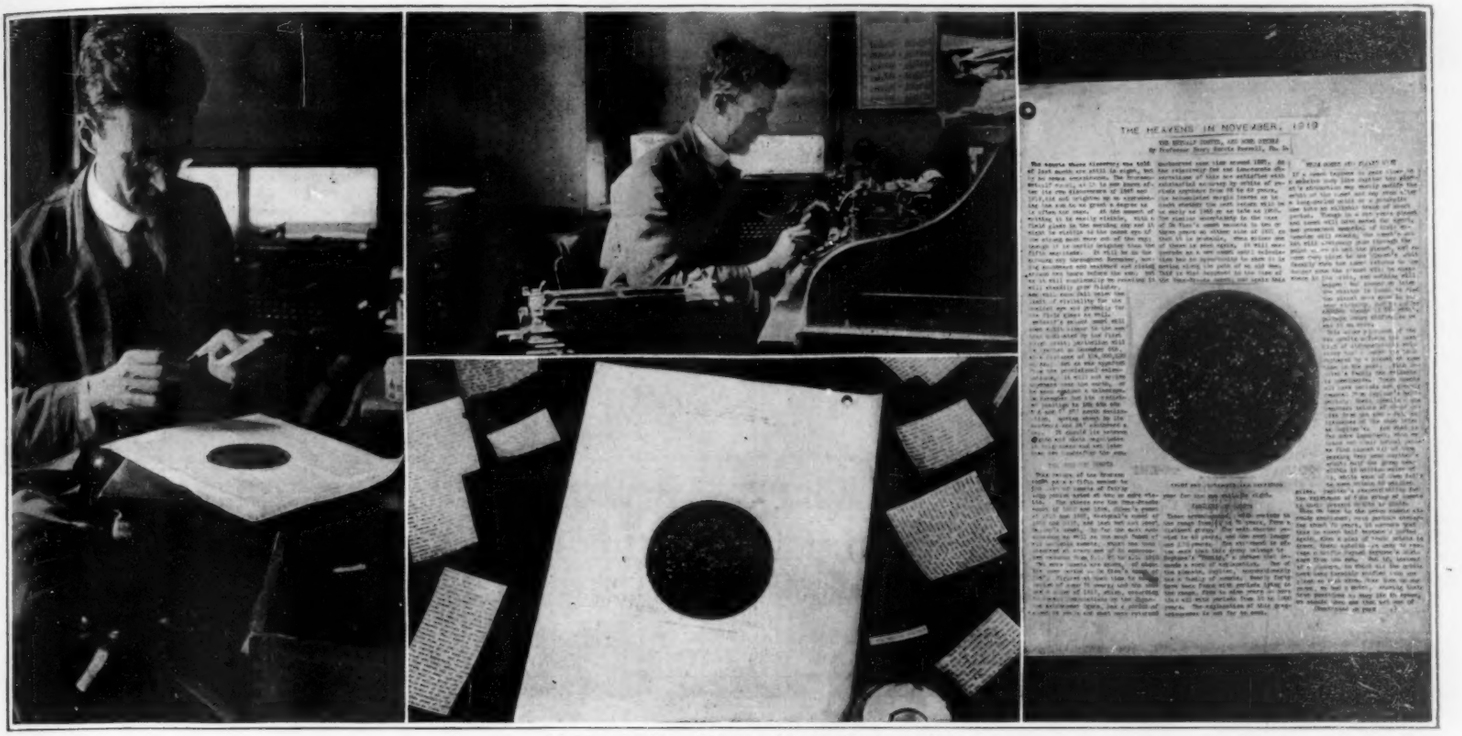
(Continued on page 594)

AFTER one trial, we were obliged to admit to ourselves that "The Romance of Invention" was one thing for which there was not room in a typewritten issue, and to interrupt the series longer than the original plans contemplated. We are very glad to resume in this issue where we left off on November 1st; and we shall have Mr. Claudy and his successful inventors with us at shorter intervals from now on.

Dr. Baekeland is an inventor in a field which many of us might not at first blush realize to be invention at all. He has no concern with machinery or mechanical movements, it is true; he does not even deal with the unvisual mechanics of the electric current. But his career shows full well that in the less spectacular inventions of the chemist there is opportunity to make great contributions and earn great rewards; and this brings him within the scope of the man who tells us of "The Romance of Invention."—THE EDITOR.



Dr. Baekeland in his laboratory



Making the Scientific American on the typewriter

Above: One of the editors surrounded by a battery of machines with different type-faces. *Left:* Making up a page with the aid of the paste-pot. *Below:* A page with head, cut and caption pasted in place, and the many fragments in which the text was made. *Right:* The same page completely assembled and pasted together.

With Typewriter and Offset Press

How the Scientific American was Manufactured in the Absence of Compositors and Pressmen

MANY of our friends have expressed a desire to know the details of how we did it. In the typewritten issues space was too precious; and when we found that we could get our issue of December 6th type-set, time was too precious. This week we have both space and time; so we hasten to tell the story before it gets stone cold.

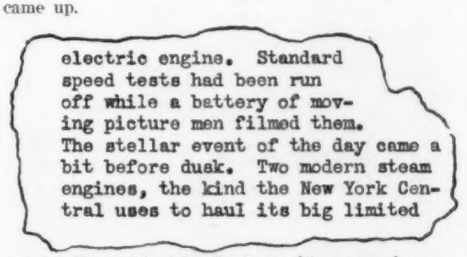
Some three years ago our printer brought to our attention a process of "offset" printing which is peculiarly adapted to color work, and which we have used ever since for our covers. In a general way, this involves printing from an etched plate on to a rubber roller, and then laying down the impression from the roller upon the paper. The rubber from which this final transfer is offset is absolutely smooth, instead of being recessed or raised along the lines of the design like an engraved plate or an electrotype, respectively. Hence the process is classified as one of lithography.

This scheme, developed as a substitute for the familiar "process-plate" printing of colored posters, covers, etc., was never intended to displace the printing of type matter from electrotypes. But when the feud in the local pressrooms threatened a suspension of work, we realized that the offset press was capable of doing type forms in black and white, and we prepared to use it in this way.

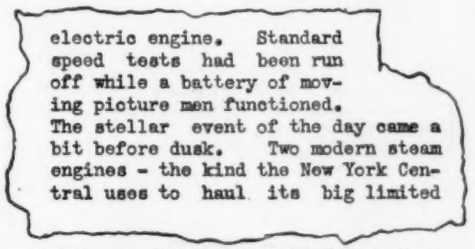
The program was simple enough. We were going to set our issues in the regular way and insert the half-tone blocks in the regular way. Then instead of sending the locked form for each page to the electrotyper, we were going to pull a nice clean proof of it, and photograph this for reproduction on the offset plate. But while our issue of September 27th was in the composing room, it was announced that the compositors, too, would go out on October 1st.

To meet this situation in part, in four successive days (September 22nd to 25th) we produced editorially four issues of the SCIENTIFIC AMERICAN for October, sent three of them to various composing rooms, got the proofs back, and read them. To the uninitiated this may not mean much. We don't know just how to get a clear impression across of what it ought to mean, except to suggest that it involves bringing four well-balanced issues into being out of nothing, and doing the essential work of four weeks in as many days. A Chicago colleague who heard of what we had done characterized it as the most extraordinary editorial achievement of which he had ever heard. We are inclined to cite our issues for October as exhibits, and let it go at that. Perhaps the fact that no other publication affected by the printing tie-up made any effort to handle even two issues at once will convey some notion of what it meant for us thus to handle four.

The issues of October 11th and 18th were printed on the offset press, as planned. But as the time drew near for us to go to press with the issue of the 25th, and we realized that there was no possibility of getting it set up, we looked about us for another resource; and we decided to try the typewriter. We found plenty of hard nuts to crack, but we went right ahead with the job, disposing of each problem as it came up.



A few lines of text for the typewritten magazine, as they look after "roughing out"



And the same lines in their finished form after a second typing

For instance, a glance at our issue of October 25th will show that the type is pretty thick and fuzzy. In later issues this is progressively remedied. Here is the one place where we had to call in outside aid. We went to typewriter headquarters for advice on ribbons. It was pointed out to us that a fabric ribbon of any kind must in the nature of things give an impression that will spread more or less, and we were supplied with a paper ribbon in which this characteristic was absent.

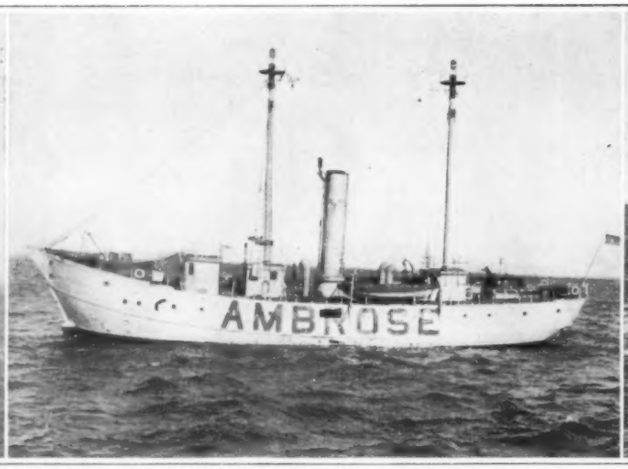
The paper ribbon is inked only on the side toward the roller. The type, therefore, never comes in contact with any ink and never clogs. The machines which we used have not been cleaned, yet only a few of the most used letters show any traces of black from the ribbon. The type cuts the ribbon, and hence the latter can be run across the machine only twice—once on the lower half, and once on the upper. It makes an impression not very pleasing to the eye, because of a persistent lack of uniformity in tone as the stroke varies from letter to letter. But the absence of any fiber in the ribbon insures a perfectly clean-cut, crisp impression. The camera corrects the variation in tone; it will not correct the fuzzy, fringed effect given by a fabric ribbon, but actually exaggerates this. For photographic reproduction the paper ribbon can be considered in a class by itself.

If we had been able to print in the regular way, we should have reduced the typewritten text in photographing it. A contemporary which had to resort to typewriting a week before we did, and which therefore beat us on the stands with a typewritten issue when in reality we had scored over it, reduced by one-third with good effect after it adopted the paper ribbon; before that the thick type made the reduced matter hard to read. But a combination of happy circumstances made it possible for this contemporary to keep its pressroom running, while all others were closed. Our offset process of printing, itself an emergency measure, does not give type matter in quite such clean-cut form as the regular printing press, and on this ground we decided to compress in the writing of our articles, rather than in their production.

Another problem was that of page architecture. Should we attempt to run type matter around cuts, or should we restrict ourselves to half-tones of such size as to have full-width columns for the text? Here we adopted the bold course, making the typewritten issues as nearly similar in form to the normal ones as possible. We have set "type" in columns as narrow

(*Continued on page 596*)

Romer Shoals lighthouse, New York Harbor; consists of circular steel caisson, heavily riprapped with steel tower



Lightship at the entrance to Ambrose Channel, New York. Length 135 feet, beam 29 feet. Carries masthead light and 12-inch steam whistle

Acetylene gas and whistling buoy, Ambrose Channel, New York

Signposts of the Sea

The United States Lighthouse Service

THERE are some departments of the nation's governmental service which make a distinctly sentimental appeal, and among these may safely be reckoned the United States Lighthouse Service, which, to use the official language "is charged with the establishment and maintenance of aids to navigation and with all equipment and work incidental thereto on the coasts of the United States." This includes light stations, light vessels, fog signals and buoys of all kinds.

The headquarters of the Lighthouse Service is at Washington, D. C., and is known as the Bureau of Lighthouses. The service is divided into nineteen lighthouse districts, each under a lighthouse inspector. There is a central office in each district, and at each there are technical forces employed in construction and up-keep, and the usual clerical employes. In each district, also, there are one or more lighthouse depots for distributing supplies and apparatus; and on Staten Island, in the third district, is a large general lighthouse depot for the storing and distribution of general lighthouse and other supplies.

The jurisdiction of the service covers the Atlantic coast, the Gulf, the Pacific coast, the Great Lakes, the principal internal rivers, Alaska, Porto Rico, Hawaii and all United States territory except the Philippine Islands and Panama. The history of the service in the United States dates from the year 1715-16, when the first lighthouse to be erected was built at the entrance to Boston harbor, the light of which consisted of a common fish oil burner with solid wick. The development was slow in those early Colonial days, as will be seen by the fact that in 1790 the total number of lighted and unlighted lighthouses, buoys, beacons, et cetera, was only 107. By the year 1840, the total was 1,180; by 1870, it had tripled to a total of 3,456, and by the opening of the present century, the total was 8,921. In 1915, there were 14,544 lighted and unlighted structures under the care of the Lighhouse Service. Of these aids to navigation, 5,155 are lighted and 9,389 are unlighted.

In the early Colonial days, the lighthouse lights were extremely simple, using a solid wick and common fish or whale oil. Sperm oil began to be used in 1812 with reflectors; but reflectors built on correct optical principles were not used until 1840. The first lens to be used was placed in the Navesink light in 1840-41. The use of lenses in place of reflectors had become general in the United States by the year 1859. Since that time there has been a steady growth of the power of the lights, and the largest today is that at Makapun Point, Oahu, Hawaii, which has a focal distance of 52.4 and an inside diameter of lens of nearly nine feet, the whole being enclosed in a lantern having an inside diameter of sixteen feet.

Once a year all of the lighthouses are filled up with a year's supplies, and twice a year there is an inspection of every lighthouse which is made unannounced so that everything may be maintained at the top notch of efficiency. Thousands of the good people of the United States can testify, from personal visits paid during holiday seasons on the seacoast, to the cleanliness and general spic and span appearance of Uncle Sam's lighthouses, and to the unvarying courtesy of the attendants or the keepers in explaining the equipment and operation. The life is, of course, a more or less lonely one, but the staff is well housed and well fed. The "time off" varies according to location. Thus, the Romer Shoals Lighthouse in New York harbor is looked after by two keepers and each man has eight days' shore leave per month, taken in two-day periods, the matter of shore leave being arranged so that the other man is not alone for any extended period. Next to the lighthouse in importance come the lightships, with which we are all more or less familiar. They are anchored over shoals, at the entrances to harbors, and in positions where local conditions make it impossible to erect a lighthouse. We present a picture of a typical lightship well known to Atlantic travellers, which is anchored at the entrance

Steel drum on lighthouse tower with hose connection for charging gas buoy

of Ambrose Channel leading to New York. The modern lightships are stout vessels, built of steel, with a high freeboard and lofty bows. They carry powerful lights at the mastheads, and are provided either with a fog horn or a powerful steam whistle or siren. This ship measures 135 feet by 29 feet and is anchored in place by heavy mushroom anchors, the hawse pipe is located at the bottom of the stemhead where it shows clearly in the illustration. They are provided with comfortable quarters and the crew have a ten-day shore leave per month. They are taken off either by one of the lighthouse tenders or they can come ashore in their own power boat.

For guiding shipping through the channels into harbors, an extensive use is made of the modern gas buoy which consists of a large hemispherical or cylindrical buoy which forms the reservoir for the gas, and a light which is carried at the top of a vertical pipe or a frame of lattice construction such as that shown in our illustration of a gas buoy at the Ambrose Channel, New York. These buoys are of two types, known as the pintsch gas buoy and the acetylene buoy. The pintsch-gas type is charged with gas at a pressure of twelve atmospheres, and has a capacity of about two months' continuous burning night and day. In the acetylene type, the buoys are charged by inserting gas cylinders which can be removed when empty. These acetylene holders are packed full of a clay-like substance of secret composition, associated with which is a certain amount of acetone. This filler is of great absorbent quality, so that a tank will take in about ten times the normal quantity of gas for each atmosphere of pressure. When thus fully charged the acetylene buoys will burn for a year continuously night and day. The gas is taken out to the buoys in large cylinders and for recharging it is merely necesary to connect a hose from the tender to the gas tank in the buoy.

Outwitting the Stubborn Burdock

A WEED pest of wide distribution, particularly obnoxious because of its numerous prickly burrs, is the burdock. The burdock, while very much a farm weed pest, likes company, and is happiest when usurping by its own peculiar use of "squatter's rights," a corner of the barnyard, a favorable nook in the orchard, or some spot in the village or city backyard which has not received constant cultivation. Cutting it down doesn't do any good, for the burdock develops a root system possessing wonderful vital tenacity, and promptly "comes up" again.

Like the well-known hero of antiquity whose only vulnerable spot was on his foot, the charmed life which the burdock seems to bear really is only a semblance. The burdock has its vulnerable spot, but few know where it is. In parenthesis, it might be observed, it is thus with many weed pests. Nature has provided them with resistance against all ordinary onslaughts, but like the heel of Achilles, there is a fatal weak point which, when known, becomes their undoing.

An eastern farmer, living in a rural district where the worthless burdock had brazenly lived its parasitic life for years, happened on to the burdock's weakness—and burdock ceased straightway to be a bad pest on that farm. This farmer cut, using a bush scythe, the burdocks infesting a fence corner. They were flourishing, arrogant burdocks—the kind that grew as tall as a man nearly, and for a brief period in the summer, when the green burrs make elegant balls and cushions, are a delight to the children.

This farmer cut them all down with a scythe. A few hours later—it was in hot, dry weather—it occurred to him to try to pull up the roots. Thus he stumbled on the peculiar weakness of the burdock. It has a long tap root which shrinks when the plant is first cut. If the plants have been cut off about four inches above the ground, leaving a hilt which can be readily grasped, and if the pulling is attended to while the tap root is still in the shrunken state, it is possible to pull the tap root up almost to its bottommost end.

Noises Made to Order

TRAP-DRUMMING elevated to the *n*th degree and its recognition as a properly interpretative music instead of merely an incidental to orchestration, is the latest contribution to music brought about through the motion picture. Under the direction of the drummer of a leading New York motion-picture theater—a drummer, by the way, who is a master noise producer—a well-known film producer is putting out a "sound sheet" to be used in conjunction with his animated cartoons. Indeed, it is claimed that these sound sheets have enhanced to a marked degree the mirth-provoking qualities of these pictures. And we can well believe it.

From a baby's rattle to a 500-pound anvil, from a five-cent bazoo to strangely complicated sliding whistles, from tiny tin cans with resined strings that produce the tweet of a mouse or bird to an immense tin can that roars like a lion or growls like a bear, the paraphernalia of this master noise producer covers an incredible range. He does not know how many contraptions he has, offhand; and one beholding them scattered around him while a film is being projected is at a loss to understand the uncanny precision with which he snatches the proper instrument from the bewildering array while his gaze remains fixed on the screen in order to "take the cue" for his noises. Every bit of action, of course, calls for a certain kind of noise.

When this master noise producer is at his specialty, namely, putting noise behind an animated cartoon comedy, the further oddity occurs of the trap-drummer leading the orchestra. Where ordinarily he occupies a somewhat subordinate though necessary place among the fifty musicians comprising the orchestra, he now rises to supremacy, with the others joining in only as he summons them.

There is no quality of sound beyond reproducton by this master noise producer. He makes the drawn figures on the screen come to life, interpreting through humorous noise their every movement and virtually making them talk. The result of his development of this specialty is all that he hoped for, since it permits the ear to join the eye in registering the comedy with naturally heightened effect upon the risibilities of the audience.

The "sound sheet" already referred to is issued to theaters using the animated cartoons for which the sheet is prepared. It is in the form of a regular music score, except that in place of violins, flutes, trombones, 'cellos and the like, the instruments indicated will be almost everything from a scrap of iron cornice and a piece of coarse wire-netting to dulcet-toned sound boxes and tiny soft-singing horns.

Surrounded by paraphernalia ranging from tiny tin cans to baskets of iron scrap, this noise-producing expert puts realism into today's comedy photoplays

Some Tricks of the Motion Picture Screen in the Making

THE old saying that "The camera never lies" should be revised. It may have been so in the days before the motion picture; but from the earliest times the screen art has made the camera lie and lie persistently and interestingly. "Tricks" are the more polite name for camera lies, and "trick pictures" are pictures which do not tell the absolute truth. Yet tricks are a big asset in photoplay production; and in the vast bag of tricks rests one more advantage of the motion picture over the stage. Today there are few pictures of the strictly "trick" category. Tricks are used rather sparingly, because there are so many prosaic themes which can be produced with straight photography. Still, pictures are used to obtain pleasing effects, and often in comedy productions to obtain a hearty laugh.

The most ludicrous and startling results are obtained by operating a camera upside down on its tripod, we are informed by Austin C. Lescarboura, in his book "Behind the Motion-Picture Screen." Several types of camera are provided with tripod holes on top as well as on the bottom, permitting their use upside down. In this manner it is possible to photograph a subject quite conventionally, yet when it is shown through a projecting machine the action is backwards; that is to say, the action starts from the rear end and runs toward the beginning. The results are easily imagined. If a man is photographed jumping into the water, the film when shown on the screen shows the water opening up (the reverse of the splash) and the performer jumping up to the spring board (the reverse of the dive) and finally the performer jumping a few times on the tip of the spring board and then running backwards off the board.

In comedies the backward movement is employed to a great extent, such as in showing automobiles racing backward, barrels rolling uphill, and so on. In the instance of a comedy villain throwing knives about his victim who is strapped to a post, the effect can be produced by first placing the knives about the victim and then pulling out the knives one by one with invisible threads as the camera is operated upside down. The villain, however, is photographed in a separate scene while throwing the daggers or knives, which action, obviously, is photographed in the usual manner.

Another device of the comedy film is high-speed action. Some scenes may show certain characters working with the speed of lightning, or a vehicle tearing along a road at express-train speed. This effect is produced by taking pictures at a rate slower than 16 images per second, and then when the same pictures are projected at the standard speed the action is accelerated proportionately.

The simple example of accelerated action—or shall we call it electrified action?—is where everything in a scene is moving at about the same gait. In this case the film was simply made at a slower rate of speed. But in those scenes where only part of the performers move at the accelerated speed while others appear quite natural, the effect calls for some care on the part of the slow-moving or normal performers. These must act very, very slowly while the other performers act in the usual manner, the action being filmed at ten or tweve images per second. Then when the film is projected at the standard speed, the effect is to speed up the slow-acting performers to the usual, natural gait, while the performers who acted at the normal speed are accelerated to ludicrous actions.

Another camera trick— two methods of making films of racing automobiles, in order to have the audience keep up with the cars, so to speak

Bombardments From the Skies

The Recent Lake Michigan Meteorite, and Others of the Same Breed

REPORTS of natural phenomena published in the newspapers generally breed a larger crop of skepticism in scientific circles than among the laity. This is hardly true, however, of items describing the fall of meteorites. The attitude of the public toward such reports is perhaps not so very different today from what it was when President Thomas Jefferson, who was well qualified to be the spokesman of the scholarly laymen and likewise of the amateur scientists of his time, declared that it was easier to believe that Yankee professors would lie than that stones would fall from heaven. The "Yankee professors" aimed at in this remark were Benjamin Silliman and J. L. Kingsley, both of Yale University, whose account of a fall of meteoric stones in Connecticut on December 14, 1807, had attracted general attention.

Recent press despatches recording the fall of a great meteorite in Lake Michigan during the night of November 26 merely add one more to the long list of well-attested events of this character. The fall of this body is said to have been attended by a flare of light visible for a radius of fifty miles and by a tremendous detonation, followed by a deep prolonged rumbling, which shook houses in many towns of southwestern Michigan and neighboring portions of Indiana and Illinois. People fled from their homes in terror, fearing an earthquake. Many attributed the noise and illumination to an explosion at some great industrial plant. A lighthouse attendant at Grand Haven, however, who actually saw the meteor fall, describes the phenomenon as follows:

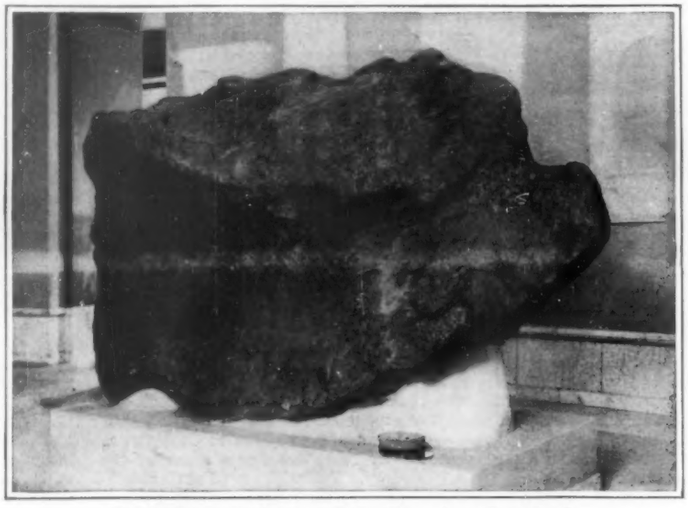
"What looked like a ball of fire appeared to fall in the lake about fifteen miles south of me. In its rush downward at terrific speed I could clearly hear it whistle. When it seemed that it was striking the water, a flash of flame shot up and caused a great disturbance."

The study of meteorites is so uncommon a specialty that it has not yet even acquired a specific name in English. Dr. O. C. Farrington, our leading American authority on this subject, has suggested the term "meteoritics," but he has not told us whether the exponents of this specialty are to be called "meteoriticists" —or what. Meteors, or shooting-stars, as seen in the sky, are now observed systematically by a large and growing body of scientists and amateurs. There is an energetic American Meteor Society, with headquarters at the University of Virginia, and there is an equally active Meteor Section of the British Astronomical Association, led by that veteran student of meteors, W. F. Denning. On the other hand, meteorites—the meteoric bodies that actually fall to earth—are the hobby of a mere handful of mineralogists, such as Farrington in America, and Sir Lazarus Fletcher in England.

Because the study of meteorites is a neglected byway of science, few people realize that falls of these bodies are, in the aggregate, exceedingly common, and are often quite as sensational in their attendant phenomena as the one recently reported from Lake Michigan. A long list of these events is given by Farrington in his interesting book on meteorites, published in 1915. Many brilliant falling-stars have been observed in broad daylight. For example, a meteor of intense luminosity was seen at Mocs, Hungary, on February 3, 1882, at 3:45 p. m. It was accompanied by a rolling noise and violent detonations. The meteor left behind it a long white stripe, like a cirrus cloud. About a thousand stones fell to earth, the largest of which weighed 150 pounds. The fall which occurred at Sokobanja, Serbia, about 2:00 p. m., October 13, 1877, was, says Farrington, introduced by two explosions like salvos of artillery, accompanied by a brilliant display of light such as attends the bursting of shells. A dense black smoke was observed at a considerable altitude, and this broke up into three columns, which gradually changed to a white smoke. The noise lasted for some time and resembled the firing of musketry. Soon after the first sound a number of meteorites fell over an area a mile and a half in length and a half-mile in breadth. The largest of these weighed 84 pounds. The meteoritic shower which occurred near New Concord, Ohio, about 12:30 p. m., May 1, 1860, was introduced by a strange and terrible report in the heavens, which shook the houses for many miles about. A very impressive fall occurred at Homestead, Iowa, on the night of February 12, 1875. A meteor was seen in the sky so bright that the light could hardly be tolerated by the naked eye turned full upon it. The meteor and its train were tinged with prismatic colors, and "sparks" were thrown off as the body sped through the sky. This display was followed by a deafening explosion, which became a rushing, rumbling and crashing sound. The reverberations seemed to shake the earth to its foundations, buildings quaked and rattled, and people believed that an earthquake was in progress.

Leaving the astronomical problems connected with meteors out of the question, there is no mystery about these phenomena. A body of matter entering the earth's atmosphere from outer space is intensely heated at its surface by the friction of the air, and hence becomes luminous. Moreover, to quote from Farrington:

"The slowing up of a meteorite by the resistance of the air exerts a powerful disruptive force upon it, since the rear of the meteorite tends to travel with a planetary velocity while the forward part is being checked. Thus Hauser calculated that a meteorite having a volume of a cubic meter and being a square meter in section would, if moving at a velocity of 30 miles per second, develop an internal disruptive force of nearly 3 billion kilogram-meters on arriving within 16 miles of the earth's surface."



The 36-ton meteorite brought by Peary from Greenland

This huge mass is 11 feet long and is five feet wide

These figures suffice to explain why meteorites so commonly burst into fragments before reaching the ground. Lastly, the noise attending the fall of a meteorite is mainly occasioned by the sudden heating of the air along its path, and is therefore analogous to thunder. The prolonged rumbling often reported is, as in the case of thunder, occasioned by the fact that sound travels slowly through the air, being outstripped by the meteor itself, so that the sound from the nearer parts of the meteor's path reaches the observer sooner than that from more distant parts of the path.

Brilliant illumination and tremendous noise do not necessarily indicate that a very large body has fallen to the earth. The largest individual meteorite known is the "Cape York meteorite," brought by Peary from Greenland in 1897 and now preserved in the American Museum of Natural History, New York City. It weighs 36½ tons. The following list of the largest known meteorites is given by Farrington:

Name	Weight in kilograms	Where preserved
Cape York	33,113	New York
Bacubirito	27,500	Mexico
Chupaderos (2 bodies)	20,881	Mexico
Willamette	14,110	New York
El Morito	10,000	Mexico
Bendego	5,370	Rio Janeiro
Cranbourne	3,731	London
Adargos	3,325	Mexico
Cape York (No. 2)	2,727	New York
Casas Grandes	1,545	Washington
Quinn Canyon	1,485	Chicago

The Peary meteor, it will be recalled, is so large and heavy that the Commodore was unable to bring it home with him when he first discovered it, but had to organize a later expedition with special equipment for handling this mass of iron. Yet it weighed more than this when it fell, since the natives of a goodly portion of Greenland had been using it for centuries as a source of raw material for arrow tips. This huge stone, which we illustrate on this page, is 10 feet 11 inches in extreme length, 5 feet 2 inches through at its thickest point, and stands 6 feet 9 inches high.

It is still a mooted question whether a much larger meteorite than any of these—possibly 500 feet in diameter—produced the remarkable formation at Canyon Diablo, Arizona, variously known as Coon Butte, Crater Mound, and Meteor Crater. This is a circular depression about 4,000 feet in diameter and 570 feet deep, occurring in the surface of an otherwise comparatively level plain. There are no positive evidences here of volcanic action, and, on the other hand, thousands of iron meteorites have been found about the crater, weighing, in the aggregate, several tons. These circumstances have led to the plausible hypothesis that the crater was formed by the impact of a gigantic meteorite; but numerous borings made in the crater have not revealed the presence of any buried meteoric mass, and a search for such a mass with magnetic instruments has likewise yielded negative results. The owner of the property, however, claims now that this search has always been carried on at the wrong point and in the wrong direction, under a mistaken notion as to just where and from what quarter the hypothetical meteorite must have struck. Certainly, if the meteor theory be correct, the celestial projectile which effected this scar upon the earth's epidermis must by all means have been the largest of which we have any definite trace.

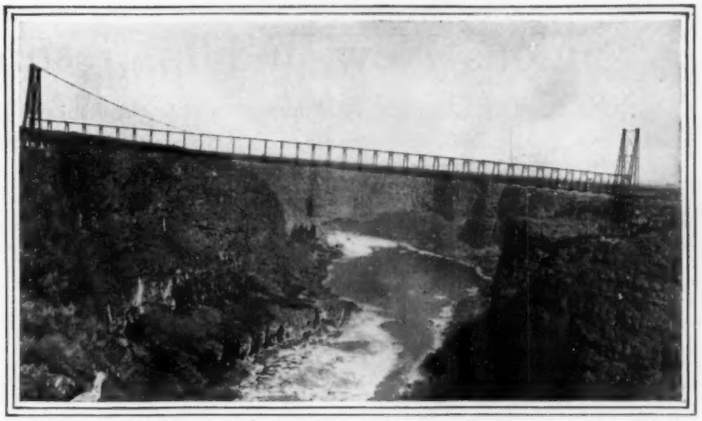
Art of Measuring Screws

ONE of the arts which the war has immensely stimulated in Great Britain is that of metrology, or exact measurement. Probably the most difficult, as well as perhaps the most important, of all measurements to make with complete accuracy in engineering, are those connected with screws. Hitherto the accuracy of a screw or screwed part of a piece of mechanism has been secured as far as was possible by the use of a series of gages, which always include a "go" and "not-go" gage. The series sometimes has numbered as many as seven different instruments, all necessarily expensive to produce, very liable to injury when finished, and subject to considerable wear and tear. By the use of these gages a degree of accuracy has been obtained which permitted no error exceeding one-thousandth part of an inch in the case even of ring screws. This degree of accuracy, however, has not been considered sufficient, particularly for master gages, and, as a matter of fact, in the master gages used for plug screws an accuracy corresponding to one ten-thousandth part of an inch has been secured by the ordinary methods. Nevertheless, it has long been felt that some better method of measuring screws was needed than the usual appliances provided. Obviously, while an ordinary check gage might fit an internal screwed part apparently perfectly, it was impossible to say whether the check was bearing at all points of the screwed surfaces. These considerations have led Prof. P. E. Shaw, of University College, Nottingham, to design a machine for measuring screws in which he secures, in the measurement of any kind of screw, "simplicity and certainty of point contact." Instead of merely ascertaining whether a particular screwed part comes within the limits of the "go" and "not-go" check gages, as a whole, the new machine is designed to measure any screw at any point of the screwed surfaces and will do so to less than the 1/10,000 part of an inch.

A Bridge at a Dizzy Height

WHENEVER we hear a given structure characterized as the biggest or the longest or the highest or the heaviest or the smallest or the lightest or the this-or-that-est of its kind in the world we make a mental reservation. Our national predilection for superlatives, which has been so freely commented upon, leads us to make statements of this sort with a good deal of recklessness; and in addition to this, there is the fact that many of the implied comparisons involved in a claim of the sort mentioned have never been explicitly made. We behold a fountain with an enormous volume of flow, and are at once tempted to suppose that it must be in the front rank, if not actually at the head of the procession; but in the absence of a catalog of all the world's fountains, made with reference to their rates of flow, who shall tell us just how this one stands? Moreover, if it is first today, tomorrow it may be second, and next week relegated to an obscure position in the rear.

In spite of the hesitation with which we thus approach the claim of the superlative, we should think that the bridge illustrated on this page might well support the assertion which our correspondent makes that it is the highest suspension bridge, if not in the world, at least in America. At considerable pains he has managed to take a photograph which shows this extreme height; the actual figure is 345 feet from bridge floor to the stream. It spans the Snake River in southern Idaho, near Twin Falls, the width of the canyon from pier to pier being 688 feet. Aside from any question as to its extreme height, it is of interest because of the fact that all materials had to be hauled some miles to the site, and because of the very short time—four months only—required for its construction. It was dedicated late in the summer, and is now in service.—*Henry H. Graham.*



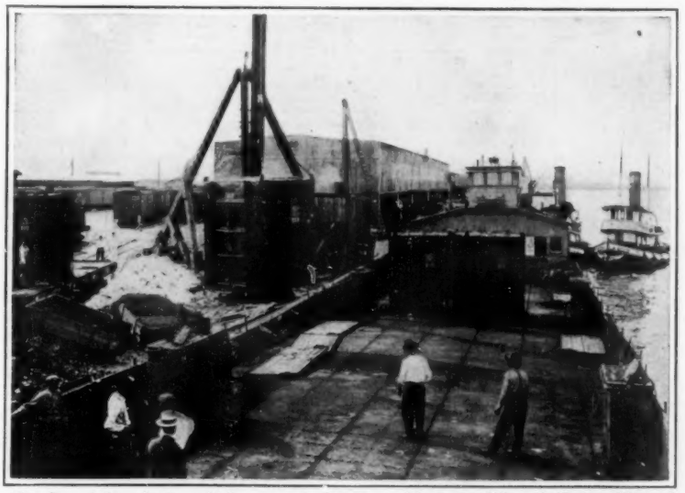
This bridge, which spans the Snake River in Idaho, is believed to be the highest in America

The Nuzha-Persika—the "nut-peach"—which is distinguished from all other peaches by the possession of a smooth skin and an edible sweet almond kernel

Screened Sea-Shells for Chicken Scratch

THE small ocean-beach town of Wilmington, California, near Los Angeles, is virtualy built upon sand—fine ocean sand and broken sea-shells. Years ago the site was no doubt covered by the sea, but the waves gradually built up an ever-widening embankment of the sand and the shells and thus the water was everlastingly forced to "give ground." As a result, many acres of this mixed deposit have been left high and dry, spreading back some two or three miles from the present beach, and over which the buildings of the small town are now scattered.

In the last few years this shell-laden sand has given rise to a considerable and rather unusual industry. It was found that the broken shell could be easily screened from the sand, and that the bits of shell made excellent "chicken scratch"; moreover, that there was a surprisingly big demand for such product. Hence, this town of Wilmington is today shipping sea-shell chicken scratch to all parts of the country, by the carload, and those who are engaged in the several phases of the business are realizing a very satisfactory remuneration, on scarcely any investment aside from their labor.



Steel container in transit from car to barge, making possible a bulk handling of freight that would ordinarily have to travel in much smaller packages

A Peach with Smooth Skin and Sweet Kernel

SOME three-quarters of a century ago Darwin reasoned that the peach was a descendant of the sweet almond. He had in mind doubtless the woolly or slightly downy skin of the peach, and the familiar downy green skin or husk enveloping the sweet-almond nuts as they grow; perhaps also the passing similarity of the grain-marks on the kernel shells of each. The almond-nut shell is perfectly smooth; the outer surface of the peach nut is characterized by tiny ridges to which the meat of the fruit adheres, often tenaciously; but if the ridges be worn down smooth by mass motion of the nuts in a sack, as pecans are "polished" in bags, the similarity to the smooth sweet-almond shell will be such that some wily Levantine exporters are able to adulterate a percentage of bitter peach

(*Continued on page 598*)

Steel Containers That Help in Handling Southern River Traffic

THE remarkable development of river traffic under the stimulus of U. S. Government direction has made necessary the use of mammoth steel containers for handling the great quantities of merchandise shipped from New Orleans to points in the Warrior River and Tombigbee River districts. On the down-river trips coal is carried on the barges, but on the return trips the greater part of the cargoes is carried in the steel containers. These are about one-fourth the size of a box car and have a capacity of 10 tons. They are filled at the warehouse, factory, or refinery, conveyed by railroad to the side of the wharves, then swung aboard the Government barges by means of stiff-leg derricks. These steel containers protect the merchandise from the weather and from fire. When the barges finally reach their destinations, derricks again pick the steel containers from the barges, place them aboard flat cars, and make them ready to start on the final lap of their journey.

Five self-propelled barges of 900 tons capacity are now operating between New Orleans and the Warrior River region. Each barge can handle something like a trainload of merchandise in containers. The Government has set aside $12,000,000 for the development of the Warrior River since it began to rehabilitate river traffic. It has given that channel a minimum of eight feet of water throughout the entire year.—*Geo. F. Paul.*

A pile of coarse sea shell ready for the crusher, and a "chicken-scratch" screener and his outfit

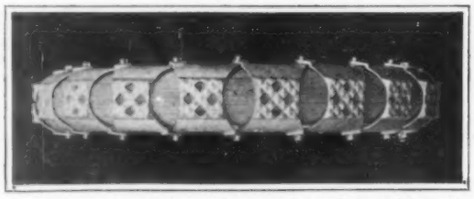
Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A Tire Chain Made Up of Interchangeable Units

PATENTS have been secured by George R. Belknap, of Spokane, Wash., on a "non-skid auto chain" that is creating interest among Spokane motorists.

The device can hardly be called a "chain." The links, which are interchangeable in case of breakage, are flat on the running surface. The entire link is "U" shape, the tire fitting into the opening of the "U." The face, which strikes the pavement, is two inches square and is corrugated. Extra links may be added in a twinkling to make the chain fit a tire of any size. When properly applied the chain will be noiseless. It will act as a tire protector and it is claimed that when the tire is removed after the chain has been used for a season, the tire will be in the same condition as when the chain was applied. In case of puncture it will not be necessary to repair the tire, the broad links of the chain make a smooth running surface and the car may be driven to the nearest garage without the slightest injury to tire or rim. The rim or the tire is not damaged. It is estimated that the chain for 30-inch tires will weigh approximately 14 pounds when manufactured from malleable cast iron. It occupies but small space and will prove a boon to truck and motor owners.

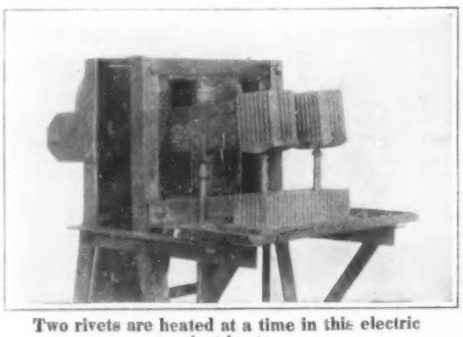


Interesting tire chain made up of interchangeable units

Heating Rivets by Touching Them

IN an effort to overcome the many difficulties involved in heating rivets previous to their being driven and riveted, an American manufacturer of electrical equipment has recently designed an electric rivet heater which embodies low first cost with simplicity of operation, fool-proofness of construction and maximum efficiency. This is accomplished in the following design:

A transformer rated at 15 kilowatts is mounted on angle iron legs, which may be fitted with wheels. At the front of the transformer, two copper bars are fitted with heavy air-cooled electrode blocks of cast copper, and under these is another copper block which acts as a support and electrical connection for two rivets in series. When the rivets are stood up on the block and the electrodes are allowed to drop on the head of the rivet, the circuit is completed and heating begins. The two electrodes may be raised independently by two foot pedals, gravity being sufficient to lower the electrodes when the foot is removed. A primary tap switch mounted on the back legs of the machine gives all the variation needed for different lengths and diameters of rivets and rate of heating desired.

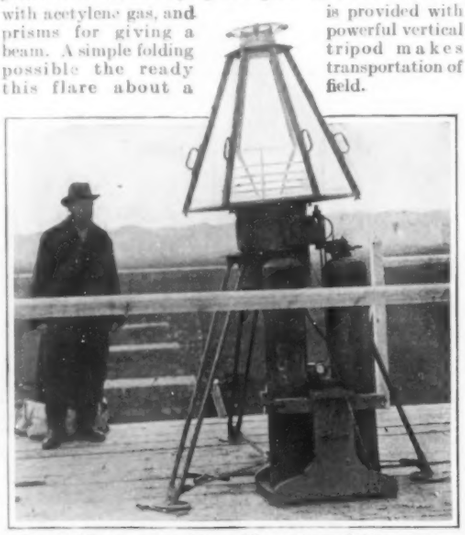


Two rivets are heated at a time in this electric rivet heater

Lighthouses for Airmen

GREAT BRITAIN is exerting every effort to be the first in commercial aviation, just as she exerted every effort during the war to be the strongest in the air. The matter of air regulations has been settled for the British Isles; there are numerous companies in England conducting passenger and freight transportation systems by means of airplanes, and there are proper arrangements made for the guidance and alighting of the airmen.

The accompanying illustration shows one of the flares recently introduced in Great Britain for the guidance of airmen flying at night. This flare operates with acetylene gas, and is provided with prisms for giving a powerful vertical beam. A simple folding tripod makes possible the ready transportation of this flare about a field.



A portable flare used to guide nocturnal fliers over England

Keeping Switches Free of Ice

THE accompanying illustration and drawing show the method of operation of a device for melting the snow that gathers in switch-points, as developed at Chicago, Ill. It can be placed in the fall and is ready for use at any minute and for any length of time until removed in the spring; it eliminates labor urgently needed in other branches because it is easily used by unskilled help and cannot get out of order.

This electric heater being enclosed in a case, as illustrated, leaves nothing to freeze and it is weatherproof with no flame and no danger to signal circuits. It requires very little expense as it costs money only when there is a snow storm. There is great danger to men who try to clean rail switches during a blinding storm and they refuse to jeopardize life and limb in this hazardous work.

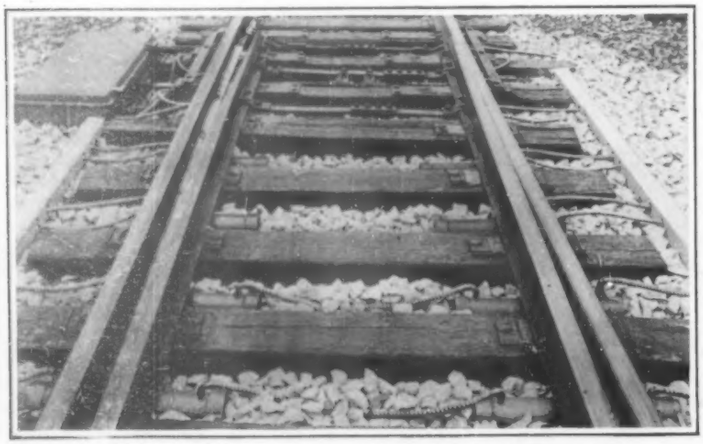
It will be seen that this electric snow-melting device is purely and simply an electric heater enclosed in a 3½-inch wrought iron pipe, 20 inches long. These heaters are placed between the ties, just under the rail. They are wired from such a circuit as the amount and character of the supply current makes necessary, and a switch is placed in this wiring at some convenient point clear of the track. When a snow storm starts the current can be turned on by an employe as easily as an electric light. The heat generated does the rest.

The temperature in the heater rises about 100 degrees Centigrade in the first half hour and by the end of an hour is about 135 degrees Centigrade above the outside temperature. This heat is not enough to set fire to anything, but is sufficient to remove frost from the ground so that the snow which falls is melted. This melting snow makes a light mist which prevents the accumulation of snow or its freezing on the slide plates and keeps the space on the slide plates, or under the tie rods or other mechanism, free for operation. The same thing is seen on sidewalks that lie over ovens or furnaces. In an ordinary storm this is completely effective and the track above the heaters is kept as dry and clear as a floor.

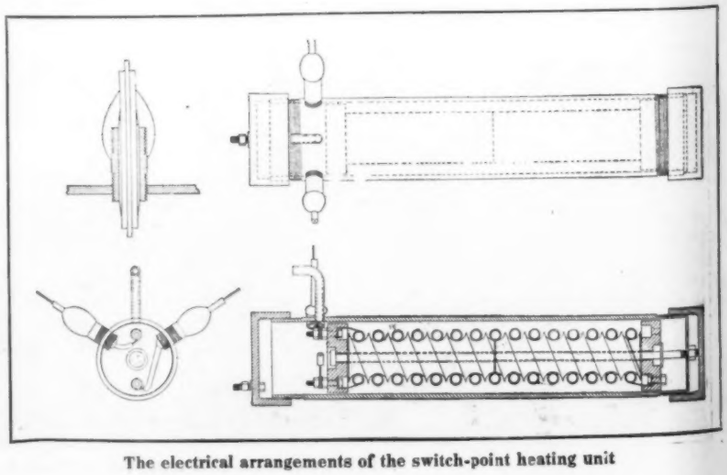
Each of these heaters uses 11 amperes and 36 2/3 volts and can be used for either alternating or direct current with equal effectiveness. The current consumption is very small. There is no gas to freeze or be blown out by the wind or to cause explosion of any kind.—*Frank C. Perkins.*

The New Rothamsted Laboratories

THE world-renowned agricultural research establishment at Rothamsted, England, has recently undergone considerable expansion, the latest token of which was the opening of a fine new laboratory building on October 20, 1919. The ceremony was attended by a distinguished company of men and women interested in scientific agriculture and kindred subjects, and the building was formally opened by Sir Arthur Griffith-Boscawen, parliamentary secretary of the Board of Agriculture and Fisheries. The Board has recently established at Rothamsted an institute for the study of plant pathology.



Electric heating unit to keep switches clear in winter weather



The electrical arrangements of the switch-point heating unit

Recently Patented Inventions

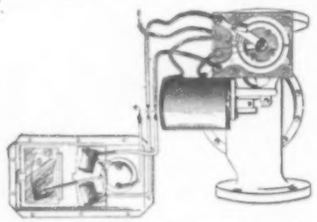
Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Apparel

WOMAN'S GARMENT.—L. KALINA, 384 Alabama Ave., Brooklyn, N. Y. The object of the invention is to provide certain improvements in women's dresses and gowns whereby the lining when soiled or injured can be quickly removed from the garment and cleaned, or replaced by a new one, without requiring any changes in the construction of the garment. Another object is to permit an accurate fitting of the lining to the wearer's body without altering the garment, and to permit the user to readily change the sleeves together with the lining if desired.

Electrical Devices

ELECTRICALLY OPERATED VALVE.—J. E. DAVIDSON and C. HOLLAND, 722 Colorado St., Butte, Mont. This invention relates generally to valves, and more especially to that type of valves having self-contained electrical mechanism adapted to be operated by an electrical current from a distance. An object is to provide a service valve arranged to be installed in a pipe line at the



A REAR VIEW OF THE INDICATING DEVICE AND PERSPECTIVE VIEW OF SWITCH BOARD SHOWING VALVE CLOSED

required places, and including a closing mechanism which is operated by an electric current. Another object is to include indicating mechanism at the place from which the valve is to be operated, the position of the closing member of the valve being thereby ascertainable by the operator.

SPARK PLUG ELECTRODE.—B. ROSENBERG, 1275 President St., Brooklyn, N. Y. The invention has to deal more particularly with the construction of the central electrode. The object is to provide electrodes which will always maintain a clean sparking surface, this being obtained by the electrode embodying in its construction freely movable bodies, such as balls, which are agitated by the vibration of the engine and thereby have a cleaning effect on the electrode.

ELECTRIC HUMIDIFIER.—R. J. PATTERSON, Berlin, N. H. The invention has for its object to provide a simple inexpensive device of the character specified capable in small sizes of attachment to an ordinary lighting circuit and by means of which the amount of moisture in the air of a room may be held at any desired degree.

SPARK PLUG.—J. E. KUEHNE, 781 S. 18th St., Newark, N. J. The object of the invention is to provide a spark plug arranged to effectively protect the porcelain insulator against injury liable to be inflicted on accidentally dropping the spark plug or twisting the same when screwing it up or unscrewing it. Another object is to prevent rain water, spray, and other moisture from passing into the spark plug and thereby causing short circuiting, and to permit of readily taking the plug apart, for cleaning or repairing.

ELECTRIC FUSE.—J. SCHNEIDER, 441 E. Jersey St., Elizabeth, N. J. A specific object of the invention is the provision of a fuse having a fuse wire associated with a mass of sand or other granular non-conductive material, so that when the fuse wire is melted at a weakened point outside of the said material a spring operates to pull one part of the wire into the sand so that the latter will form an obstruction over the end of the wire and thereby extinguish the arc.

ELECTRIC WELDING TONGS.—H. F. KUNTZMANN, 218 Moffart St., Brooklyn, N. Yi The invention relates to implements used in the art of electric welding. Among the objects is to provide a pair of tongs having metallic portions adapted to serve best for electrical purposes, having handles covered to protect the operator, and also having jaws peculiarly shaped with respect to the work or wire to be held and for the best manipulation by the operator according to whether he is right handed or left handed.

Of Interest to Farmers

YIELDING MOUNT FOR PLOWS AND OTHER TOOLS.—E. DUNLAP, Diamond Springs, Cal. This invention has for its object to provide a yielding mount for plows, which will enable the operator to raise the plow above the ground by the pull on the draw bar or the forward movement of the frame. The plow may be supported above the ground as long as desired by means provided and may be returned to operative position by movement of an operating member.

Of General Interest

COAL HOLE COVER.—M. GRAF, 1048 Kelly St., Bronx, N. Y. The object of this invention is to provide means for securing a coal hole cover to its base, and has particular reference to a removable or detachable hinge construction for the renewal or interchange of covers, and also with respect to a key controlled automatically closing lock whereby the cover cannot be opened from the outside by any one not in authority or without the key.

FILM FOR CAMERAS.—O. SARTORIUS, J. F. GANDARA and B. COLONNA, Box 421, El Paso, Texas. The object of the invention is the provision of a film consisting of sensitized and non-sensitized portions arranged in alternating relation throughout the length of the film to permit of focusing an image between the successive exposures whereby a visual image for each portion exposed may be observed before introducing the same into the focal plane.

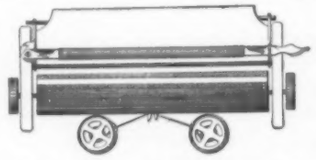
PROCESS AND APPARATUS FOR REFINING OILS.—J. R. MILLER, 1214 E. 8th St., Okmulgee, Okla. An object of the invention is to provide a process for cracking hydrocarbon for gasoline, toluol or benzene, which is more economical than the ordinary process. A further object is to provide a form of apparatus for carrying out the cracking process, by means of which the process may be rendered continuous, the synthesis tower having a relatively large capacity, permitting the gases and vapors to be held therein a sufficient time to bring about the desired results.

BOAT DAVIT.—T. SCHRODER-NIELSEN, Horten, Norway. By this invention the angle of the davit axis and the form of the davit are so adjusted that the boat rib is brought to the level of the ship's deck, when the boat is swung out whereby the boat may conveniently be manned without lowering the same and without being hindered by the rolling of the ship or the ship having a list.

APPARATUS FOR THE DISTILLATION OF COAL.—A. PONET and A. DEBOUT, Paris, France. This invention has reference to the manufacture of coal gas. It consists in using coal previously crushed to a fine degree, and in producing the distillation by passing the coal in a very thin layer either upon an inclined plane or between two vertical partitions located in proximity to each other, suitably heated and maintained at the desired temperature so that during the period the coal slides or drops the distillation may have entirely taken place.

COMPARTMENT CONTAINER.—D. BROWN, care Louis A. Brown, 299 Broadway, New York, N. Y. This invention relates to containers for coffee, tea, cocoa, and other material where it is desired to keep the contents in their original condition, the object is the provision of a structure wherein segregated quantities may be maintained in their original condition in a sealed container, the device is provided with a plurality of compartments the contents of the respective compartments may be removed individually.

ERASER PAD.—J. H. POU, JR., 2105 9th St., Wichita Falls, Texas. The foremost object of the invention is to provide an eraser pad attachment for typewriters, by means of which the pressure is taken off of the carbon sheets while



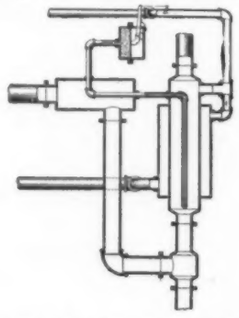
PLAN VIEW SHOWING THE ERASER PAD IN PLACE UPON TYPEWRITER

making an erasure, so as to avoid the ill-appearing "smudge." Another object is to provide an attachment which may be made to assume a normally inoperative position, but can be moved around into place when there is use therefor.

COAL CHUTE.—F. E. GROSVOLD, care Arthur H. Shoemaker, Eau Claire, Wis. The object of the invention is to provide a simple coal chute which is provided with a suitable latch mechanism which can be placed into inoperative position to allow the chute to be raised, and which chute has means for operating the latch as the chute is raised to place the latch in position to automatically lock the chute when the same is closed.

CLOTH CUTTER.—C. E. CLARK, 40 W. 4th St., New York, N. Y. An object of this invention is to provide a construction wherein the knife used will continually move across the cloth in the same direction. Another object is to provide a cloth cutter with a built-up knife arrangement in sections, and with a pivotally mounted sharpening device for sharpening the knives at any time.

TEMPERATURE REGULATOR.—H. BROOKS, Box 472, El Paso, Texas. This invention relates to a device for controlling the temperature of fluids, either liquids, gases, or air passing through the device. The invention may be employed for regulating the temperature of fluids generally, important instances being the regulation of the temperature of hydro-carbon fuels in their preparation for rapid combustion either



A SECTIONAL SIDE ELEVATION OF A FLUID HEATING AND REGULATING MEANS EMBODYING THE INVENTION

in internal combustion engines or in a furnace burning crude oil of a heavy asphaltic base. The general object is to automatically regulate the temperature of the fuel according to varying operating conditions with respect to heat.

BATHER'S PURSE.—P. GLAMZO, 127 Grand St., Brooklyn, N. Y. The invention relates to water tight purses for bathers' use, and particularly to water tight cases of all kinds which may be carried on the person. A purpose of the invention is to provide a special design of case fitting with a compression packing which will give a hermetically sealed seam or joint along the contacting edges of the opening portions.

CONTAINER.—R. W. HICKS, 435 Fifth Ave., New York, N. Y. Among the principal objects which the present invention has in view are, to hermetically seal a boxlike container to prevent moisture passing through tte walls, to heat insulate the walls, to provide a removable interior for the container, and to simplify the construction. The device is more particularly intended for storing cigars or tobacco, to prevent the impairment of the flavor.

BOMB OR SHELL.—J. MARTENA, 154 Bleecker St., New York, N. Y. This invention has for its object the provision of a construction which may be used as an aerial torpedo, mine throwers' shell, or depth bomb to explode either on contact with a hard substance or at a given point in the water. Other objects are to provide a shell which may be set to explode as it enters or rises from the water, or before it reaches the surface, and to provide for its safety until the various parts have been set, so that rough handling will not endanger any one's life.

INDEX CARDS.—J. A. BEST, 25 Broad St., New York, N. Y. The invention relates generally to card indexes, and more particularly to means whereby to effectively expose the upper edges of a series of cards, so that the indicia of the series will be simultaneously exposed and in this way avoid the necessity of turning or otherwise manipulating each individual card for this purpose as required in the usual card index.

FLYTRAP.—S. SCHRANTZ, 5938 Minerva Ave., St. Louis, Mo. One of the principal objects of the invention is to provide a trap having a chamber in which the flies are trapped, which chamber may readily be removed for immersion in boiling water or other liquid for killing the trapped insects. Another object is to provide a flytrap which will be exceedingly simple, durable, and inexpensive to manufacture.

CARGO SLING.—I. HEFFRON, care Isaac Heffron Stevedore Co., Galveston, Texas. An object of the invention is to provide a cargo sling to be used in loading and discharging the cargo of a ship, an important feature is to provide a sling including a flexible support consisting of longitudinally disposed cables, having a plurality of slats mounted thereon by slotting the ends of the slats to receive the cables, said slats being slidable on the cables and thereby readily conforming to variously shaped objects.

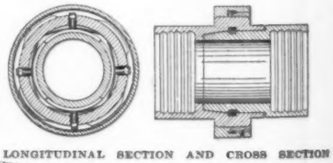
MANUFACTURE OF EMBROIDERY.—J. NATER, 806 Sip St., W. Hoboken, N. J. The object of the invention is to provide means in the manufacture of embroidery according to the Plauen, or etching process, whereby the embroidery including its minutest detail is maintained in its original shape, and an exceedingly fine finish is given to the embroidery without requiring the pressing or ironing or rehandling of the goods.

SYRINGE.—O. O. R. SCHWIDETZKY, Hasbrouck Heights, N. J. This invention relates to syringes having a barrel provided at one end with a nozzle, and at the other end with a rubber bulb for drawing liquid into the barrel and ejecting it through the nozzle to any part. The object is to provide a syringe arranged to permit the user to readily draw liquid into the barrel and to prevent the drawn in liquid from flowing into the bulb on holding the syringe with its nozzle upward.

SEPARATOR.—N. SCHWARTZ, 251 W. 34th St., New York, N. Y. The object of this invention is to provide a separator more especially designed for use in respirators, gas masks and similadevices, and arranged to dissolve, neutralize filter or separate poisonous fumes, smoke, gases or dust, contained in the air breathed by the userr Another object is to permit of conveniently re. charging the separator with neutralizing agents when necessary.

ALLOY.—F. MILLIKEN, 55 John St., New York, N. Y. This invention relates to an alloy, the basis of which is made up of copper 40-48 per cent, nickel, 8-12 per cent, iron, 1-6 per cent zinc, 38-48 per cent, manganese 1-3 per cent, which are mixed with certain other metals, whereby the alloy is capable of being rolled, forged, drawn or worked in other ways while the metal is hot, or it may be worked while cold, the alloy is also highly resistant to acid.

AUTOMATIC HOSE COUPLING.—J. B. GAGNE, Donacona, Quebec, Canada. The main object of this invention is to provide a hose coupling cheap to manufacture, perfectly water proof, and so constructed as to enable the interlocking members to automatically lock. A further object is to provide a coupling which can be



A LONGITUDINAL SECTION AND CROSS SECTION

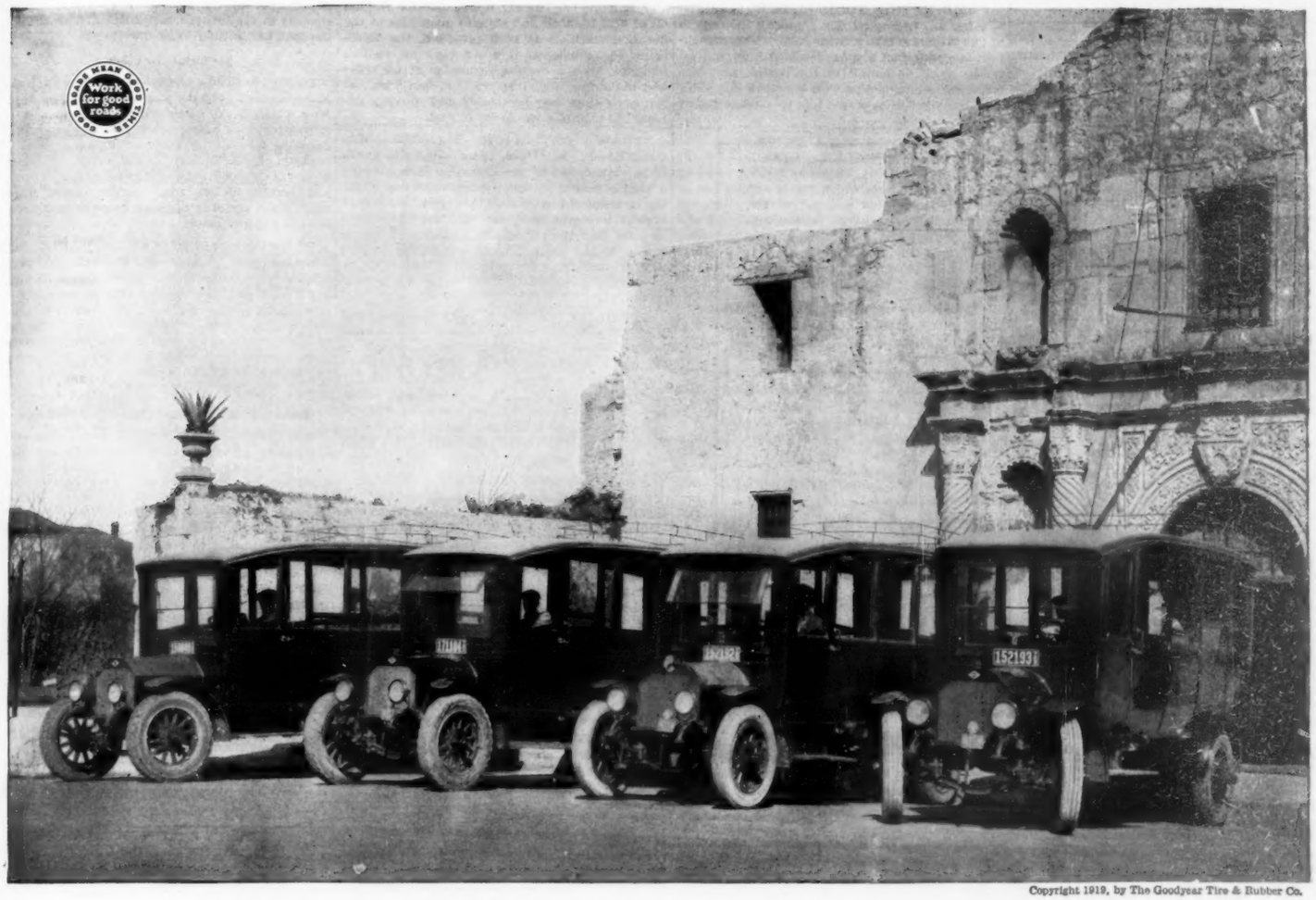
easily and quickly locked or unlocked. The coupling is provided with interfitting male and female members, one of which is provided with a groove and the other with a movable locking member in the form of a collar.

APPARATUS FOR ASCERTAINING THE FUSING TEMPERATURE OF MATERIALS.—Z. OLSSON, Toomsboro, Ga. Among the principal objects of the invention are to provide means for accurately measuring the heat conditions of substances, to provide means for standardizing the heat conditions for repetition thereof, to provide a visible scale of heating conditions, and to thereby save time when ascertaining the fusing or other heat conditions of articles.

PORTABLE ASH-SIFTER.—J. I. ORMSBY, 63 Hopkins Ave., Jersey City, N. J. The object of the invention is to provide a compact portable ash sifter arranged to permit of conveniently and quickly sifting ashes without causing any dust to pass into the cellar or other room in which the ash sifter is used. Another object is to permit of conveniently removing from the apparatus the separated ashes and the cinders after the operation is completed.

CONCRETE MOLD.—H. G. LARZELERE, 44 High St., New Rochelle, N. Y. An object of the invention is to provide a form for molding concrete structures consisting of sectional standards

(*Continued on page 590*)



"WE recommend Goodyear Cord Pneumatic Truck Tires to anyone operating passenger-carrying busses. They afford the obvious pneumatic advantages of traction, cushioning and greater activity which benefit both the customers and the company. But they add a wearing ability which compares favorably with the solid tires we have used. Consequently, we use Goodyear Cords entirely for bus equipment."—M. P. Brannan, Pur. Agt., Merchants Transfer Co., San Antonio, Texas

THE photograph above was taken at The Alamo in San Antonio, Texas, and it shows four motor busses that carry tourists to this and nearby missions.

In two years of continuous service on Goodyear Cord Pneumatic Truck Tires not a single repair has been required by any of these big carriers.

They ride as comfortably as limousines on the cushioning pneumatics and, due to the traction of their tires, they operate on schedule over country roads in rainy weather.

Officials of the Merchants Transfer Company, however, particularly emphasize the toughness of the Goodyear Cords which have averaged 12,000 miles per tire in this exacting duty.

The average tire-mile cost of nine Goodyear Cords, eight of which remain in service after more than a year, is less than seven-tenths of a cent.

Their stamina points to Goodyear's pioneer work in developing Goodyear Cord Pneumatic Truck Tires to remove the limitations placed by solid tires on motor trucks and busses.

THE GOODYEAR TIRE & RUBBER COMPANY
Offices Throughout the World

GOODYEAR

Recently Patented Inventions

(*Continued from page 588*)

and from plates than can be built up to any desired height with comparative ease, one of the features being the relative lightness of the parts whereby they can be handled easily by the workman. A further object is to provide a tie wire tightening mechanism.

DRAWING BOARD ATTACHMENT.—P. L. Raffo, 7 Sixth Ave., New York, N. Y. The object of this invention is to provide a drawing board attachment comprising adjustable means fitted into the drawing board for clamping a sheet of drawing paper in position on the board, the attachment being provided with screw-threaded clamp means, the device being mounted in the board as a permanent part thereof.

BEDSTEAD AND ATTACHMENT.—Don C. Brownell, Seward, Territory of Alaska. The object of the invention is to provide a clamp adapted to hold the bed-clothing and top mattress firmly to the spring mattress, such clamp being applied at the foot of the bedstead. The clamp facilitates straightening the bed clothes and prevents the same from being pulled off the feet o the occupant when asleep. A rack attachment is also provided over which the bed clothing may be hung to ventilate them.

STIRRING DEVICE.—C. Minsk, 204 E. 98th St., New York, N. Y. This invention relates generally to a stirring device and more especially to a device which is adapted to be manually operable, being particularly adapted for use in preparing milk and egg drinks, or for such other use wherein a thorough mixing or agitation is desired. An object is to provide a device which is simple in construction, compactly and conveniently arranged and readily adjustable.

MOLD FOR STEROTYPE-PLATES AND THE LIKE.—C. Winkler, Berne, Switzerland. The invention relates to a mold for casting stereotype plates and the like in which said plates, when cast, are cooled in a special manner. The object of the invention is to produce a plate which will answer the strictest requirements in regard to accuracy, and consequently, can be used with the best results for color printing.

ADVERTISING DEVICE.—H. K. Harris, 96 Victoria St., Westminster, London, England. The invention relates to devices for making public announcements and for other purposes of like nature and refers to such devices in which bands, cards, plates, disks, or the like or one of a number of cards or plates brought into different positions or caused to take up certain positions, so as to present a coherent announcement.

Hardware and Tools

SAW FITTING TOOL.—G. Anderson, Aiken, B. C., Canada. Among the various objects of the present invention is the provision of means by which the cap plates which serve to support the device on the cutting teeth of the saw in the swaging and filing operations may be adjusted to curvature so as to rest evenly on the points of the cutting teeth, and thus equalize any wear of the teeth.

FASTENING DEVICE.—R. H. and F. H. Bachman, 15 N. Church St., Allentown, Pa. The primary object of this invention is to provide a fastening device for chains to which a chain may be readily attached or detached. A further object is to provide means for maintaining a chain in engagement with the device at all times, and by which the chain-securing device is maintained in position against accidental displacement.

SAW OILER.—J. Schmidt, Box 885, Tracy, Cal. An important object of the invention is to provide a saw oiler which may be conveniently carried on the person, and by which the lubricant

A SECTIONAL VIEW, PARTS BEING BROKEN AWAY FOR THE SAKE OF ILLUSTRATION

may be easily, quickly and cleanly applied. Another object is to provide means adapted to house and project the lubricant applying means and to effect saturation of the lubricant applying means as desired. The device comprises a shell housed in a container, and a block of felt, or suitable absorbent material, secured in the shell.

COMBINATION TOOL.—J. H. Walker, 120 S. High St., Lexington, Ky. Among the objects of this invention is to provide a spirit level attachment operating as a spirit level both on and off of the stock or handle of the device, and also operating in conjunction with the stock in rapidly adjusting the blades of the tool to predetermined angular positions.

Heating and Lighting

DOMESTIC BOILER STAND.—J. F. Arthur, 729 Main St., Dickson City, Pa. Among the principal objects which the invention has in view are to provide a stand of the character mentioned which may be adjusted to vary the height of the same to accommodate the plumbing of different installations, to provide a stand adapted for holding boilers of different makes, with neatness of structure and strength.

Machines and Mechanical Devices

LINT SEPARATOR AND CLEANER.—F. W. Meyers, C. L. Campbell and F. H. McSweeny, 2010 Congress Ave., Houston, Texas. The invention relates particularly to means for separating and cleaning lint cotton and removing dust and dirt therefrom. The object being the provision of a machine which will continuously operate to remove the dust and dirt by mere introduction of the cotton thereto with an air blast, and which will handle the cotton without the use of movable parts, except for the purpose of adjustment.

ROLLER GRIZZLY.—L. Pinger, Fallon, Nev. The object of this invention is to provide a grizzly of the roller type, especially adapted for use in ore milling and in connection with rock crushing, to handle mine run of ore, coal or quarry

A SIDE VIEW OF THE GRIZZLY

product, wherein the grizzly is composed of rollers arranged in parallel spaced relation, and all driven in the same direction.

REVERSIBLE TURBINE.—A. Bonom, Central Building, Paterson, N. J. Among the objects of this invention is to provide a direct-action and reaction turbine comprising a plurality of oppositely moving members or rotors so designed and constructed as to possess maximum efficiency with a minimum amount of weight of material and expenditure of steam or fuel. Another object is to provide labyrinth packings between all relatively movable parts subjected to the steam pressure, and to provide for delicacy of adjustment to the packings.

MARKING MACHINE.—J. G. F. Rooker, Vrijenban near Delft, Netherlands. This invention has for its object to provide a very simple and cheap means for automatically effecting the angular displacement of the feed dog of a sewing machine to permit a character, figure, word or number to be sewed by the machine.

BURLING OR EXAMINING MACHINE.—M. Poetzsch, Lexington Ave., Passaic, N. J. The invention relates to cloth examining machines and has for its object the provision of a construction wherein the cloth is passed over a table in such a manner that the person doing the examining may properly observe all parts of the cloth without straining the eyes. A further object is to provide a machine which may be adjusted to run quickly for a time, then very slowly, or to stop for a short time.

BUTTER FAT GAGE.—E. R. Robinson, P. O. Box 116, Carneys Point, N. J. This invention has for its object to provide means to mount and adjust the gage fingers on the vertically adjustable frame, a cushioned spring to facilitate the accurate adjustment of the vertical frame, means to hold the frame in adjusted position, and a manner of mounting the magnifying glass whereby it may be swung with the swinging of the fingers, and their carrying frame.

PORTABLE COMBINED COTTON PICKING, GINNING, CONDENSING AND COMPRESSING MACHINE.—Mary W. Silvethorn, Martins, S. C. An object of the invention is to provide a cotton handling machine in which the most important feature is the combination of cotton picking, ginning, condensing and compressing mechanism on a vehicle to render the machine portable and capable of being moved into the field as an entire unit so that the complete operation from the picking of the cotton to the bailing thereof may be finished on the fields

OIL AND ACID FEEDING DEVICE FOR FLOTATION PROCESSES.—W. W. Wolcott, Georgetown, Colo. The invention relates generally to oil flotation processes of ore extraction and is more particularly a machine for feeding oil or acid in small and definite quantities to the flotation machines in such processes, the object being the provision of a machine for feeding materials with a definite regularity at all times and at various temperatures, and one which at the same time may be readily and quickly adjusted to maintain regularity of feed.

STRAW TOOTHPICK MAKING MACHINE.—F. E. Hess, Box 452, Blackwell, Okla. An object of the invention is to provide a simple device for making toothpicks of straw the arrangement being such that the alined straws are cut into even toothpick lengths, and dropped directly into the cartons in readiness for distribution to the trade. Another object is to provide a machine with means for depositing a substantially uniform number of picks into each carton.

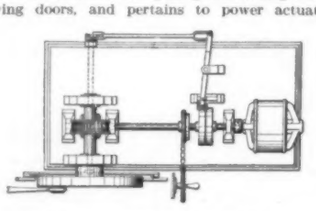
SETTLING TANK.—L. D. MacRae and P. A. MacEachern, Hotel Nacozari, Nacozar, Mexico. This invention has for its object to provide a device, especially adapted for use in flotation plants and ore dressing plants for settling flotation concentrates, wherein a tank is provided having separate launders for the clear solution and the froth, and having means for skimming the contents of the tank and directing the froth into the froth launder.

MACHINE FOR TRIMMING STEREOTYPE PLATES.—C. Winkler, Berne, Switzerland. The invention relates to a machine for trimming stereotype plates the entire surface of the plate being trimmed in a single operation by a rotary cylindrical cutter. This cutter has a length equal to the breadth of the plate and it is adjustably arranged over the table carrying the plate, and either the cutter or the table is adapted to move in the direction of the length or breadth of the plate.

IMPRESSION CYLINDER FOR PRINTING MACHINES.—C. Winkler, Berne, Switzerland. The object of the invention is to strengthen and stiffen the parts of printing machines which are normally and especially subject to strains and distortion during the time printing is in progress. This impression cylinder comprises an axis, end walls, and radially disposed internal longitudinal ribs merging integrally with the axis, said ribs integral with the cylinder and end walls and extending uninterruptedly from end wall to end wall.

ADVERTISING DEVICE.—H. K. Harris, 96 Victoria St., London, England. The invention relates to devices for making public announcements, and exhibiting advertisements, it refers to that type of device in which selector mechanisms are provided which mechanisms control the movement of the exhibiting means and select the indications which are to be exhibited, the band or other means carrying the indications being controlled from a distance preferably in conjunction with the control of the exhibiting units.

DOOR OPENING AND CLOSING MECHANISM.—S. A. Tell, 29-31 No. 1st St. Bangor, Pa. The invention relates more particularly to mechanical means for opening and closing heavy swing doors, and pertains to power actuated



A TOP PLAN VIEW OF THE DEVICE

devices therefor. Among the objects is to provide an electric motor, and means for automatically controlling the circuit of the electric motor. A still further object is to provide a power actuated means for operating said mechanism means.

HOISTING ENGINE CONTROL.—W. J. Lilly, 2819 N. Warren Ave., Tacoma, Wash. The object of the invention is to prevent overspeeding of the hoisting mechanism carrying the cage, also the prevention of hoisting the cage beyond a predetermined point at the top, or lowering it into the stump at the bottom. More particularly stated, the invention comprehends mechanism, controllable by the speed of the hoisting mechanism for shutting off the power of the hoisting engine and for applying the brake mechanism.

MECHANICAL MOVEMENT.—G. C. Ames, 651 Green Ave., San Francisco, Cal. The invention relates to converting rectilineal into rotary movement. The driven shaft has a driven element thereon with mutilated teeth to be engaged by fluid-actuated rack bars at opposite sides, means being provided to control the fluid by the driven element as well as to cause the engagement of the rack bars with the driven element in the forward movement and to release the rack bar in the reverse movement.

Medical Devices

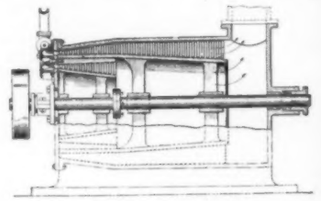
DENTAL APPLIANCE.—Gildardo Velilla M., address A. Villigas Restropo, 115 Broadway, New York, N. Y. The object of the invention is to provide a construction which is especially designed for use by itinerant dentists, though capable of use in any dental office. Another object is to provide a combined dental appliance and turning device whereby the dental tools may be sharpened or operated on as desired when used in a dental office.

DENTAL ATTACHMENT.—I. Brown, 1288 Southern Blvd., Bronx, N. Y. The invention relates more particularly to removable bridge work employed in connection with the installation of artificial teeth. Among the objects is to provide a certain form of split pin dental fixture to be used in connection with tubular supports such that the removable bridge work or artificial teeth can be periodically tightened to correct all looseness of the teeth.

Prime Movers and Their Accessories

CONNECTING ROD.—J. Gardner, Box 443, Tucumcari, New Mexico. The invention has for its object to provide a rod especially adapted for internal combustion and other engines, for connecting the pistons with the crank shafts, wherein the arrangement is such that the rod cannot become disconnected from the shaft and may be adjusted to compensate for wear.

REVERSING TURBINE.—G. W. Peterson 1519 N. Park Ave., Philadelphia, Pa. The invention relates to steam engines, and more particularly to engines of the turbine type. Among the objects is the provision of two rotors arranged

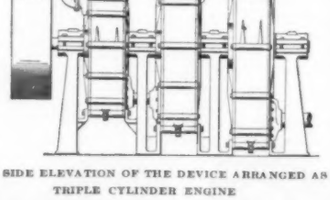


A VIEW PARTLY IN ELEVATION, PARTLY IN SECTION, OF A TURBINE ENGINE WITH PRESENT INVENTION

one within the other, the impulse blades of one of said rotors being positioned oppositely to the impulse blades of the other, and to construct the valve chest of a steam turbine in such a manner that the steam may be admitted to either of the rotors at the will of the operator.

TWO STROKE CYCLE INTERNAL COMBUSTION ENGINE.—R. H. Anderson, Edinburgh, Scotland, and J. H. Thomas, Ipswich, England. This invention has for its principal object to increase its efficiency while at the same time increasing the amount of power from an engine of given weight. The invention comprises a plurality of cylinders, each of which is formed of two diameters, the piston for each cylinder also formed of two corresponding diameters and adapted to control ports in the cylinder walls and provided in its lower portion with transfer ports, and an internal sleeve fitted to, or formed in one with, the lower part of each piston.

ROTARY ENGINE AND PUMP.—G. L. Jacques, Neillsville, Wis. Among the objects of the invention are to provide a rotary engine operated by steam pressure instead of the striking force of escaping steam; to provide a rotary pump that will elevate the fluid being pumped by direct pressure. The invention may be used as a



A SIDE ELEVATION OF THE DEVICE ARRANGED AS A TRIPLE CYLINDER ENGINE

single or compound cylinder steam engine. It may be driven by steam or explosive gas. It may be used as a rotary pump by using only one cylinder, applying the power to the shaft reversing the motion from what it would be when used as a steam engine.

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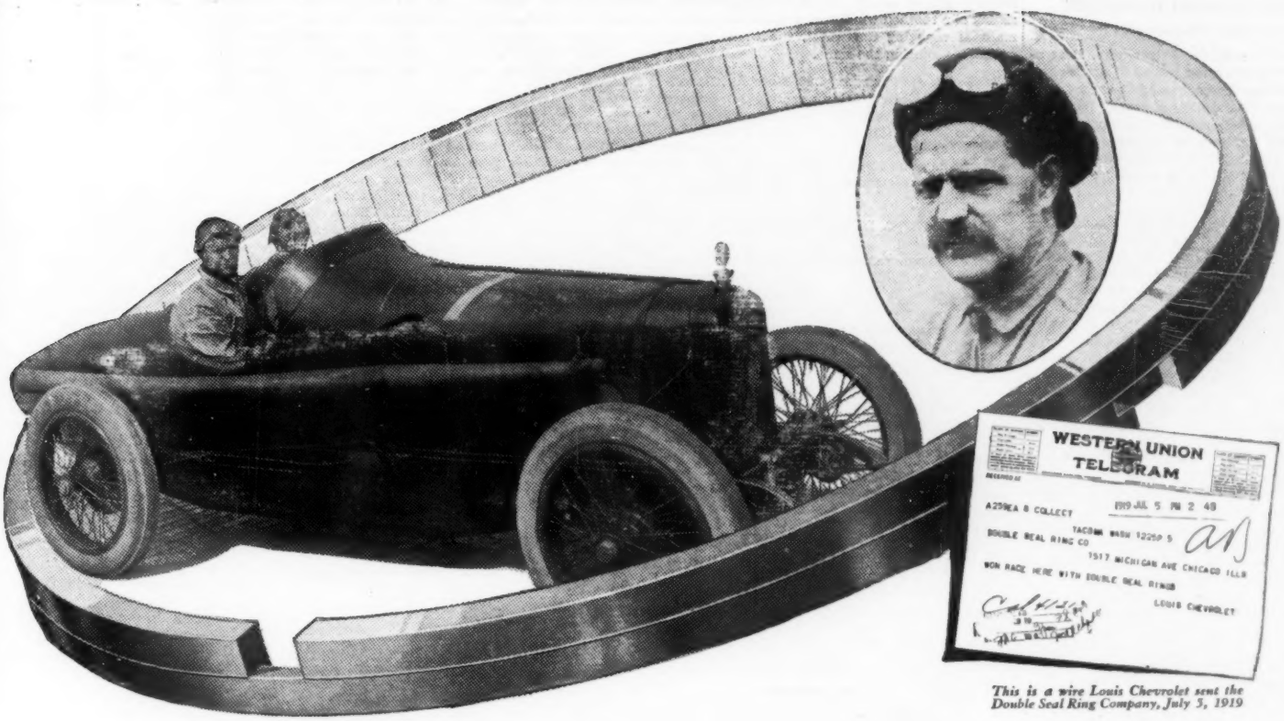

This is a wire Louis Chevrolet sent the Double Seal Ring Company, July 5, 1919

Louis Chevrolet and Double Seal Rings

500 Miles without having the hood of his car raised or putting water in the radiator—is the record of Louis Chevrolet in the great classic race at Indianapolis, May 31, 1919. Many cars in this race were so troubled with the compression and explosion getting into the crank case from the combustion chamber, due to faulty piston rings, that they were forced into the pits for long stops to wait until their engines cooled, and many of them never resumed the race. It was possible to cool the engine surrounded by the water jacket, but the crank case could not be cooled.

Double Seal Rings kept the explosion and compression of Louis Chevrolet's car above the piston rings, preventing heating of the crank case.

Professional racers are using Double Seal Rings in many races to win big prizes. They make fast cars faster and good cars better. Double Seal Rings Keep Upkeep Down. They are good Accident Insurance. They make driving a pleasure, because they put **Pep, Pickup** and **Power** in the engine.

Thousands of car owners everywhere are reviving old cars with Double Seal Piston Rings. Thousands of owners of **new-cars-that-somehow-do-not-function-as-they-should** are installing Double Seal Rings to correct their troubles. Send for our Booklet, **"Keep Upkeep Down."**

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General Sales Offices: **1517 Michigan Avenue, CHICAGO**

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PISTON RINGS

If your jobber, dealer or garage does not carry Double Seal Rings, address our nearest sales branch. Each branch carries in stock *all* sizes of rings.

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Cleveland, Ohio - 1841 Euclid Ave.
Dallas, Texas - 208 Browder St.
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Little Rock, Ark. - 414 Louisiana St.
Los Angeles, Cal. - 603 W. Pico St.
Memphis, Tenn. - 128 Monroe St.
Milwaukee, Wis. - 160 Mason St.
Minneapolis, Minn. - - 825 Hennepin Ave.
New Orleans, La., 808 St. Charles St.
New York, N. Y. - 1834 Broadway
Oklahoma City, Okla., 423 N. Broadway
Omaha, Nebr. - - 310 S. 19th St.
Pittsburgh, Pa. - 206 Werner Bldg. Hiland and Baum Streets
Sacramento, Cal. - - 1016 J St.
San Antonio, Tex., 314 Kampmann Blg.
San Francisco, Cal. - 1124 Polk St.
Seattle, Wash. - - 1213 Pine St.
Stockton, Cal., 106 N. California St.
Waco, Texas - - - 104 S. 4th St.
Windsor, Ont., Can., 19 E. Sandwich St.

Keep Upkeep Down

Recently Patented Inventions

(Continued from page 590)

SPARK PLUG.—A. N. ALEXANDER, Bergenfield, N. J. This invention relates to spark plugs for internal combustion engines and has particular reference to the construction of spark plugs with respect to the core of insulation commonly used in such a device. Among the objects is to provide a spark plug from which porcelain or the like is eliminated and for which is substituted a core of mica or its equivalent.

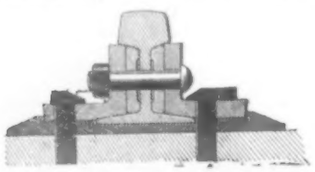
INTERNAL COMBUSTION ENGINE.—C. L. DOWNER, Idaho Falls, Idaho. An object of this invention is to provide an internal combustion engine in which is embodied a rotary valve body having ports cut on its peripheral surface in such a manner that the functions of the intake and exhaust are performed by the valve body, this body being of such a simplified construction that the engine structure is also materially simplified. Another object is to provide a valve shaft of a uniform diameter insuring a continuous bearing surface and eliminating gas pockets between the ported belts of the valve.

Railways and Their Accessories

ENGINE DRIVE WHEEL.—W. R. GARNER, Erie, Pa. An object of the invention is to provide an arrangement by means of which the driving force communicated to the drive wheel of an engine by means of the pitman is equalized around the wheel in such a manner that unsteadiness of the driving motion of the wheel is eliminated, the driving force is applied to the wheel proper on the opposite side of the axle from that to which the pitman is connected, the axle acting as a fulcrum.

RAILWAY-TIE AND FASTENER.—J. G. SNYDER, 620 W. 110th St., New York, N. Y. The object of the invention is to provide a railway tie and means for securing rails thereto. The invention also relates to securing means for articles other than rails, in such a manner as to produce a strong and simple fastening structure. Another object is to provide a metallic tie of the I-beam type, and means for holding the same in position being capable of easy tamping for holding the parts in position on the roadbed.

RAIL-JOINT SUPPORT.—J. MCR. WERTH, Box 165, Creslo, W. Va. The principal object of the invention is to provide a tie plate for rails arranged to be placed under the ends of a pair of abutting rails to prevent the loosening of the



CROSS SECTION OF A RAIL-JOINT WITH INVENTION APPLIED

joint and the bending down of the ends of the rails. Another object is to provide a support which will keep the ends of a pair of abutting rails from bending down and eliminate the objectionable "knocking" when the wheels of a train pass over the joint.

ABSOLUTE AND PERMISSIVE BLOCK-SIGNALING SYSTEM.—J. SHOECRAFT, 718 E. Clay St., Richmond, Va. The invention particularly relates to a single signal system for use on single track railways provided with sidings. The object being the provision of stationary electrical contacts disposed along the track and arranged to be engaged by a slidable contact shoe carried by the engine, the electrification of said stationary contact serving to permit the engine to proceed, but the cutting off of the current from the stationary contact resulting in the stopping of the train through the mechanism carried thereby.

RAIL JOINT.—P. WILLIAMS, P. O. Box 111, Johnetta, Pa. The invention relates particularly to joints wherein abutting rails are interlocked with each other to hold them from relative longitudinal and lateral movement. Among the objects is to provide a joint wherein both the bases and heads of the rails are connected by interlocking tongues and sockets, adapted to be engaged with each other by relative vertical movement and means for holding the rails against accidental movement, said means also acting as splice bars extending across the joint, assisting in bracing the joint against lateral thrust.

Pertaining to Recreation

TOY GUN.—F. E. CARTER, Huntington, W. Va. The object of this invention is to provide a device wherein means is provided in connection with the same for simulating the sound of a machine gun in action, the said mechanism consisting of a toothed wheel and a tongue of resilient material engaging the wheel, the wheel having means for rotating the same.

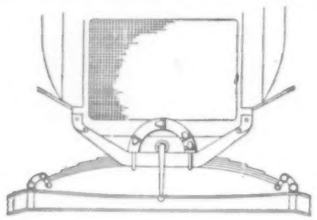
TOY.—S. C. FREDSON, 320 State St., Savannah, Ga. An object of this invention is to provide a building toy consisting essentially of a strip or stripes of material having slots cut therein at various angles and in various positions so that the strips may be fitted together in said slots and construct the representation of the framework of a building.

AMUSEMENT DEVICE.—C. F. ZIPF, Box 483, Johnstown, Pa. This invention relates generally to amusement devices, and more particularly to a novel toy or game which may be utilized purely as a toy or in connection with a game, the object being the provision of a simple inexpensive arrangement involving in its operation the movement of rolling balls.

BICYCLE RACE APPARATUS.—A. DOUGLIONE, 2265 Gravesend Ave., Brooklyn, N. Y. The invention relates particularly to what is commonly known as racing apparatus, and has for its object to provide means whereby the competitors may operate dummy bicycles at a distance. Another object is to provide means wherein the skill of operating a bicycle at high speed is utilized to propel a miniature or dummy figure at a corresponding speed.

Pertaining to Vehicles

ATTACHMENT FOR MOTOR VEHICLES.—U. S. DANIEL, Marie, Texas. This invention has for its object to provide a device especially adapted for use with Ford cars, wherein means is provided for preventing reverse movement of the crank in back firing and the like, the said



A FRONT VIEW OF AUTOMOBILE PROVIDED WITH THE DEVICE

means being normally operative to prevent reverse movement, but interfering in no way with the forward movement of the crank, the means comprises a series of pawls, and springs normally holding the pawls, to prevent the back movement of the crank.

AUTOMOBILE LOCK.—W. H. AUSTIN, 605 E. North St., Greenville, S. C. The object of this invention is to provide a lock of the character specified adapted to be mounted upon the frame of an automobile, and having means for simultaneously engaging the four wheels to lock the same from rotation, to prevent tampering with the car by unauthorized persons.

TRACTOR-SLED.—F. G. HORNER, 803 White Bldg., Seattle, Wash. The invention relates to tractor sleds or toboggans. An object is to provide a tractor for breaking trails in snow, and is primarily designed for use in northern countries where a large part of the traffic is carried on in winter over trails made in the snow. A further object is to provide a sled which is capable of having its center of gravity changed without the necessity of the driver getting out of the machine or without adding any extra weight.

MOTOR SLED.—F. G. HORNER, 803 White Bldg., Seattle, Wash. An object of this invention is to provide a motor sled which may be used for transporting goods or passengers over the snow to take the place of dog sleds. A further object is to provide a motor sled which is constructed so as to easily pass obstacles which the ordinary sled cannot pass, and which is of a flexible nature so as to accommodate itself to the inequalities of the ground or trail over which it is passing.

KNOCKDOWN CAB FOR AUTOMOBILE TRUCKS.—B. D. GINN, Carnesville, Ga. The invention relates more particularly to cabs for automobile trucks, the object being the provision of a simple and durable cab of a sectional knockdown nature, which in its knockdown form may be transported in a package of minimum size and which may be readily erected without the necessity of special tools and implements, or requiring the services of skilled mechanics or persons.

VEHICLE WHEEL.—H. D. REY, Avarua, Island of Rarotonga, Cook Islands, New Zealand. The invention has for its object to provide a wheel arranged to permit a quick and easy assembling and disassembling, the wheel being composed of a rim, a hub and two series of spokes connecting the hub and the rim, each series being an integral structure, and so braced against the hub and the rim as to give the maximum of resistance.

LOCK FOR MOTOR VEHICLES.—T. A. PERDUE, 740 W. Central Ave., Toledo, Ohio. The object of this invention is to provide a lock of the permutation type for locking the transmission controlling lever of a motor vehicle in neutral position, and to prevent if desired the full movement of the reverse lever. The device comprises a plate having its under surface cut to fit to the upper face of the H plate of a motor vehicle.

METER.—M. SMITHEY, Lawrenceville, Va. The object of the invention is to provide a form of meter to be used with an automobile or other similar vehicle for the purpose of keeping track of the mileage of tires or other similar parts of the vehicle, there being an odometer or registering device for each of these individual features.

AUTOMOBILE SIGNAL.—H. K. SMITH, Union, S. C. An object of this invention is to provide an automobile signal including a rotatable signal member with means for shielding a portion of the signal member and render visible only those rays of light passing through the signal member above the shield when the signal is illuminated. Another object is to provide a headlight, with a lamp adapted to be continuously lighted in the dark, a signal member being mounted circumjacent to the headlight.

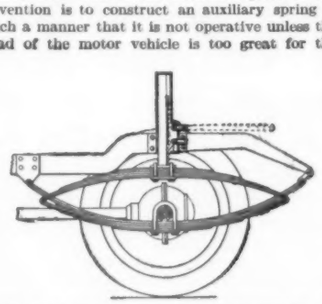
LOW PRESSURE ALARM FOR PNEUMATIC TUBES.—W. A. HARRIS, 238 John St., Greenville, S. C. The invention relates more particularly to a low pressure signal for pneumatic tires or tubes, the object being the provision of a simple device which may be applied directly to the usual valve tube of a pneumatic tire, without change in the structure, and will operate to effectively sound a signal upon the fall of pressure within the tire below a predetermined point.

ENGINE STARTER.—G. L. KAHLE, Bohemia, L. I., N. Y. The invention relates to starting devices whereby mechanical means are used for turning over the engine from the driver's seat, or from any other convenient point. A further object is a provision of arrangement of gears and cams whereby when the engine is being turned over the cams will throw the gears into mesh and will automatically throw them out of mesh when the engine has been properly moved.

LENS FOR HEADLIGHTS.—L. and H. BENZER, 141 Robbins St., Brooklyn, N. Y. The invention relates particularly to lenses adapted for use in headlights of motor vehicles. The object of the device is to provide sufficient light to properly illuminate the road surface without presenting a direct glare which is blinding to drivers of motor vehicles approaching the light. This object is obtained by providing a plurality of angularly disposed facets on the outer surface of a headlight lens.

RESILIENT WHEEL.—S. GROSSMAN, 1038 Fails St., Bronx, N. Y. Among the objects of the invention is to provide a wheel having the general appearance of the popular type of automobile wheels, but in which there are provided inner and outer rim members which are normally concentric with the axis of the wheel but between which there is adaptability for relative radial movement resilient means being provided within the spokes or hub to resist such radial movement.

SPRING SUSPENSION FOR MOTOR VEHICLES.—F. T. SWANSON, Box 217, Hayward, Cal. One of the several objects of the invention is to construct an auxiliary spring in such a manner that it is not operative unless the load of the motor vehicle is too great for the



SIDE ELEVATION OF REAR CONSTRUCTION OF VEHICLE WITH ATTACHMENT

ordinary spring suspension thereof. A further object is to provide a spring in which the tension may be regulated by the weight of the load, and may be set automatically or manually by the operator of the vehicle.

GAGE.—H. MCN. SHWAB, care G. A. Dechel Co., Louisville, Ky. This invention relates to gages for indicating the air pressure, and has for an object the provision of a gage and associate parts whereby the same may be attached either temporarily or permanently to the valve stem of a tire to indicate continually or intermittently the pressure in the tire.

AUTOMOBILE HOOD.—C. T. SILVER, 100 W. 57th St., New York, N. Y. The object of the invention is to provide an automobile hood having horizontally disposed corners which prevent the sparking plug from short circuiting by rain and which permit the rapid escape of the heated air adjacent the top of the hood, while preventing the escape of cooler air at a lower level.

AUTOMOBILE SIGNAL.—E. G. BALCH, 103 State St., Newburyport, Mass. This invention has particular reference to devices adapted to be used upon automobiles, cars, marine or aerial carriers or other vehicles. More specifically the invention contemplates the provision of a signal casing so located and constructed, as for example at the top of an automobile that it may be plainly observed at all times and from either front, rear, or either side. A further object is to so locate the device as to insure that it shall be no obstruction, under ordinary circumstances.

END GATE FOR AUTO TRUCK.—T. L. LILLY, R. No. 1, Box 12, Minonk, Ill. The object of the invention is to provide a gate of the character specified wherein an auxiliary gate is provided in connection with the main gate hinged to normally close an opening in the main gate and arranged to swing outward to permit the partial unloading of the truck to release the main end gate, when hauling gravel, grain, coal or the like.

LOCK FOR MOTOR VEHICLES.—E. B. STAFFORD, 226-29 Hennew Bldg., New Orleans, La. This invention has for its object to provide a device capable of attachment to the steering gear and movable thereon into and out of operative position, and adapted to engage the clutch controlling pedal for holding the same in neutral position when desired, the said means being capable of being locked in desired position.

IDENTIFICATION TAG.—C. M. HAHN, Valentine, Neb. The object of the invention is to provide a tag especially adapted for identifying motor vehicles, wherein the tag is shield shape, and of metal, is provided with an annular field for receiving embossed numerals, the tag being

A FRONT VIEW OF THE TAG

adapted for connection with a motor vehicle over an opening provided in the vehicle, and closing the opening, clearly advertising by the opening lift by the removal of the tag that the tag has been removed.

Designs

DESIGN FOR A STATUETTE OR SIMILAR ARTICLE.—R. SMITH, 822 C. of C. Building, Portland, Ore.

DESIGN FOR A TOBACCO BOX.—ELLA F. DE FOREST, 6 Spring Hill Rd., Norwalk, Conn.

DESIGN FOR A FLAG, PENNANT, SIGN, EMBLEM, OR ARTICLE OF A SIMILAR NATURE.—J. W. BELL, Jr., 982 Manhattan Ave., Brooklyn, N. Y.

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Blankets—a piece of card board over part of the radiator core—radiator hood covers—and other makeshift methods are all typical of winter driving with the average car.

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Again the Helicopter?

(*Continued from page 577*)

peculiar to operation upon an aircraft. Broadly speaking, the mechanism used consists of two geared rings secured to plate steel disks and placed parallel, one above the other, with interposed geared pinions set oppositely and horizontally—the pinions being extensions of the shafts of the propulsive motors. Thus, the operative power is applied equally and in unison to both gear wheels, and continuous contact is assured by rollers bearing upon annular flange-like tracks on the upper and the lower faces of the top and bottom gear wheels, respectively.

Owing to the manner in which the pinions of the prime movers are interposed between the gear wheels, it is entirely practicable to arrange symmetrically a number of engines about this intermediate apparatus and to bring all or only some of them into action as occasion requires. Indeed, it is proposed to carry a reserve engine, which can be thrown in at will or automatically if one of the motors goes dead.

This feature is counted upon to meet a contingency where more speed or lift is desired or to safeguard against disablement when aloft. The one criticism of the present type of helicopter advanced by competent experts is that the machine may not be able to volplane like an airplane if its propulsive power fail. This inability has yet to be established. However, the craft would, undoubtedly, have to return to earth if one of its two motors failed. Even so, with only half of its engine power to draw on, the two propellers should be able to permit the helicopter to settle gradually and at a rate that would not invite damaging impact with the ground.

Post-Bellum: Britain and the Inventor

(*Continued from page 578*)

different countries, can be appreciated by an examination of the above chart which shows the total number of patents granted by the Government Patent Offices of the United States of America, Great Britain and Germany, respectively, during the years 1901 to 1913. The chart does not show the number of applications that were filed at the British Patent Office, but only those for which patents were granted alike to subjects of Great Britain and to foreign inventors, the number of patents applied for in England as provisional applications being about double the number that are followed up six months later by the complete applications.

The second chart illustrates the fluctuations in the total number of applications for British patents that were filed and sealed during the years 1903 to 1918, the drop following the outbreak of the war being very great. The falling off that is shown by the chart has been entirely recovered at the present time, as during the first nine months of 1919, a larger number of applications for British patents has been filed than in any like period before the war.

Considerable doubt has arisen and much debate has followed concerning the levying of annual taxes or fees by way of renewal charges upon inventions that have been patented in most countries of the world other than America. An examination of the third chart will show that in Great Britain only 4.6 per cent (forty-six per thousand) of the patents applied for in that country by residents and foreigners, are considered by their owners as worth keeping alive by the payment of annual fees and taxes up to the end of the fourteenth year. Seeing that under the new British Patents Bill, no annual tax is to become payable until the end of the sixth year and then only five pounds for the seventh year, or but fifty shillings if the patent is made subject to the grant of licenses, the opinion generally held by those who have to work and are actually commercially concerned in developing and carrying the inventions into effect is, that it is an immense advantage to have absolutely removed from the Patent Register those patents that are utterly impracticable and have proved useless and worthless to their owners, as by their continued existence they may not only become opportunities of annoyance and hindrance to other industries, but when acquired for exploitation purposes by adventurous and irresponsible persons, vexatious and frivolous proceedings may be occasioned in repudiating unjust and unwarranted demands.

Romance of Invention

(*Continued from page 580*)

arts, and its manufacture is already a huge industry.

It is possible that the reader has not heard of bakelite. But it is hardly possible that he has not either seen it or used it. Bakelite is made into billiard balls, wireless telegraph apparatus, transparent fountain pens, automobile starters, battleship switchboards, moldings for cameras, phonograph records, casings for precise scientific instruments, telephone receivers, pipe stems, railroad signals, grinding wheels, umbrella handles, articles of ornament, buttons, automobile radiator caps and a few thousand other things.

Without a rather exact chemical knowledge it is difficult to say just what bakelite is, or rather so as to say it that the reader will know what is meant. To remark that bakelite is oxy-benzyl-methylen-glycol-anhydride is not particularly illuminating.

Bakelite is a synthetic material. It is among the best of the insulating materials and therefore finds an important place in the manufacture of all electrical apparatus. It can be most readily and beautifully machined, and as it may be made of any color and any degree of transparency to complete opaqueness, it finds opportunity to enter into the composition of hundreds of objects formerly made of wood, metal, rubber or celluloid.

Bakelite takes a sharp clean-cut impression when molded, which in many manufacturing operations does away with further machining. Because it can be molded it can be incorporated with metal or other material in the process of manufacture. It can be given a smooth and glossy finish in the mold. It does not warp, shrink, or swell.

Any one who imagines a thing like this was produced by a flash of "discovery" should talk to Dr. Baekeland about the amount of labor which went into its production. It was a lengthy process of experiment and disappointment, of investigation and trial and error, of trying first one means and then another. Into the chemistry of the process it would not be wise here to attempt to go. Suffice it that Dr. Baekeland succeeded in surmounting all the difficulties he met and in producing the substance to which his name has been given.

Dr. Baekeland has much practical advice to give to the inventor or discoverer of chemical processes of commercial worth, of which perhaps, the most important is "don't spring your discovery just because it is perfect in the laboratory . . . test it on a commercial scale, even though it is a small scale, before you bring it out for commercial exploitation."

Dr. Baekeland has taken out a great many patents . . . just how many he doesn't know himself. Many of these he has had to defend in courts of law . . . his friends say 'he enjoys his law suits almost as much as he does experimenting and producing the processes which, when patented, and proving to be successful, lead to law suits. In almost all of them he is uniformly successful and "sueing Baekeland" is no longer consid-

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ered a worth-while activity by patent pirates. The bakelite patents got into court, and came out again, unscathed, the judge clearly pointing out the radical differences between Dr. Baekeland's work and that of other chemists who had preceded him in work upon synthetic resins.

"I think the American patent system the best in the world," Dr. Baekeland said recently, "but I sometimes think of it as a small boy's trousers on a grown man. When it was established it fitted the needs of inventors and the country . . . at present it could certainly be improved. But that is a very large and intricate subject."

Dr. Baekeland exploits his own patents, rather than sells them to others. His work has made him so independent of that bug-bear of many patentees . . . the finding of capital . . . that he finds this the best method. But he has very strong ideas on the formation of companies to produce industries resting on chemical discovery, which include the conviction that the best business man is he who is wise enough to have chemists on his business board of directors.

Dr. Baekeland's list of honors is so long that he conveniently "forgets" most of them if you ask him about them, and a study of the list shows that his fellow scientists have not been behind the commercial world in recognizing a genius when they see one.

By all of which it will be seen that recognition as well as wealth wait upon careful preparation and well done original research in the laboratory and that invention and discovery with acid and alkali, no less than with lever and with wheel, may bring material, moral and social rewards of the highest order.

Dr. Baekeland is still at work on bakelite and is improving it and adding to its usefulness all the time. He is also engaged upon other intricate and interesting chemical problems, but, like the wise scientist he is, refuses to talk of research still in the experimental stage. Personally he is beloved of a large circle of friends, who value him not only for his high attainments as both scientist and business man, but for a personal character far beyond the ordinary in kindliness and enthusiasm and a charity and willingness to aid others less fortunate which makes him unusually lovable.

In closing it is pleasant to chronicle that Dr. Baekeland is very proud of his American citizenship. He is an extremely patriotic American and his work for the Naval Consulting Board during the war was of the highest importance, both in the application of his specialty to various other problems, and in that even more difficult specialty, picking the right man to do a difficult piece of work in a hurry. His friends say of him that few men have the quality of inspiring others to a greater degree, and there are many who can refer to a helping Baekeland hand as the one which led them on the right road to success.

Dr. Baekeland modestly gives to the country of his adoption the credit (because she provided the opportunity) for all his success. But those who know the man say his driving force of originality and power of thought would have brought him equal success and recognition, though the commercial path might have been harder to travel, in any other country in the world.

First and last Dr. Baekeland's interest has been concentrated in his laboratory and the fruitful investigations which have filled so large a part of his life. And, in these days, if you should not find him at his laboratory, you may look for him in the lecture rooms of Columbia University, of which he is Honorary Professor of Chemical Engineering, or engaged in the many other educational activities with which he is associated.

With Typewriter and Offset Press

(Continued from page 581)

as 1¼ inch. This of course has very direct bearing upon the ultimate fate of the typewritten magazine.

The actual work of typing the pages involves a lot of careful figuring. We found after trying it out that our 3-inch column would accommodate comfortably 36 characters and spaces, while an effort to get in 37 resulted in too little space between columns. So we adopted the "36-em measure" for our standard. Also, we found that the machine we were using gave exactly six lines per inch.

The work which we were undertaking represents the highest form of typewriting. In the case of a bulkier magazine, it would of course have been necessary to engage a special corps of typists. In our own case we found it possible to have the entire job handled by the editors themselves, who best understand the requirements of photographer, lithographer and reader. We feel that the close touch which we thus maintained with the work was largely responsible for its success, and for the continued improvement which our typewritten issues showed.

In the procedure as we finally worked it out, the first step is to lay out the page on a large sheet of bristol board. The three-column head for the top of the page, made on a special typewriter rather than by hand, was first pasted on. Then proofs of all illustrations went in, to be followed by their captions and the subhead and author's name. These were prepared on ordinary machines with slightly larger type-face than those used for the text. This of course completes the skeleton; the next step is to measure carefully to see how many lines of text are wanted for each column.

Where there are no "run-arounds" the typing of the text is simple. Where there are "run-arounds," we must borrow from the composing room, and measure the various portions of the page, laying out a schedule of the various measures and the number of lines in each. Thus if there is a wide cut in the center of the page and a wider one at the bottom, the page layout may be something like this: 16 lines full measure (36 ems); 25 lines ¾-measure (27 ems) beside the center cut; 10 lines full measure; 14 lines ½-measure (18 ems) beside the bottom cut. This would complete the first column; it would be followed by 26 lines (16 plus 10) full measure for the center column; and then by a third column corresponding to the first, except that the "elbows" where broad and narrow measures meet are at the beginning of the lines instead of at the end.

The great divide between type-setting and typewriting is the matter of "justification," or smoothing the right hand margins. On the linotype machine this is effected by an ingenious mechanical device, which depends upon the fact that as the keys are struck, the molds for the letters are merely set in place. The casting is delayed until the end of the line is reached, and can therefore be preceded by an adjustment of the spacings that will bring the end of the lines out flush. But in the typewriter you strike a key and the letter prints, and you strike the next key and the next letter prints. As each letter prints it is *finished;* there is no deferred action and no room for adjustment. So as long as the typewriter retains anything like its present form, justification can be effected only by recopying.

We were not sure that this was worth while; and we were not sure that the variable spacing between words of the same line which, on account of the fixed travel of the carriage between strokes, it would necessitate, would not be a worse eyesore than the uneven margin. However, when more pressing problems had been disposed of, we attacked this one, and found that justification was distinct-

ly worth while. The two bits of copy which we produce with this story show how we did it. In the rough copy, the desired measure must never be exceeded, except under certain circumstances which the operator learns to recognize as making it possible to compress the line by a space or two. On the other hand, it hardly matters how much too short the line may come, this can be adjusted on copying. As a guide, we usually struck off, at the top of the column of rough copy, a string of 36 x's. Also we often filled out the short lines with asterisks, so that on recopying we could see without taking our attention too far from the keyboard just how many spaces were to be supplied.

Mistakes on retyping are a bit awkward, but by no means serious. One remedy consists in retyping the offending line, and making a fresh start from there; the two or more pieces in which the column is then set are pasted on the bristol board separately. There is not the slightest difficulty in lining them up properly. We were a bit weary when we typed the "Heavens for November;" we made a lot of miscues, and as a result the finished page had to be patched together from a lot of rather small pieces. But there were occasions when we got through a whole column, involving several changes of measure, without casualty, so that the entire column could be laid down in one piece. In any event, if the pasting is accurate no damage is done; for the lithographer photographs the page through a heavy sheet of plate glass, which irons out all rough edges. This is why a comparison of "The Heavens for November" in the half-tone at the head of this story and in the issue of November 1st will show, in the latter place, none of the joints which are so plainly visible in the former.

At first we did not bother about reading proof, because we were not sure how far we could go toward making corrections. Thus it was that we credited an altitude record to the Curtiss "Wash," doubtless raising in the minds of many readers a vivid picture of a line full of red flannel unmentionables floating in the breeze at a height never before attained by any person's laundry. But after we had seen how easily the high spots were smoothed out by the photographer, we read proof; and when an error was found, we calmly retyped the offending word and pasted it over its erroneous prototype. Here we had one advantage over the linotyper, who has to recast a whole line and substitute it for the one in which his fingers slipped.

There was a good deal of material we did not have to make anew. The big headpiece of the title page; the "flag" at the head of the editorial page; department heads like those of the Inventions and Chemistry pages; the name SCIENTIFIC AMERICAN at the top of each page; the column heads on the Notes page—all these were cut from old issues and pasted in the new pages. In our first typewritten number for October 25th, we purposely introduced a lot of crudities, for the fun of the thing; the long-hand editorial page, the page numbers inserted by hand and the dates on the title and the flag altered in the same way, the page dates inserted with a date stamp, etc. But lafer we were able even to patch in the date on the title page. This, by the way, was quite a bit of patching; "November," for instance, came from an issue of a year ago, while the rest of the line, "22nd, 1919," was filched from an issue of last March, which had the same calendar as November.

The feature of these issues which gave us most concern was the illustrations. It will be understood that the half-tone reproduces its original by means of an arrangement of dots. These are all exactly the same depth of black, and they are all the same distance apart; but where the picture is to be darker, they are larger,

so that their ensemble bulks blacker to the eye. If a half-tone is examined through a glass—or in the case of the coarse newspaper cut, with the naked eye—this dot effect will be clearly seen.

These dots are produced mechanically by photographing the original through a screen with 100 or more meshes per inch. But the etched plates for the offset process are also prepared with the aid of the half-tone screen; and when the "original" from which this negative is made is itself a printed half-tone, the two series of dots interfere, giving a muddy effect which is thoroughly unsatisfactory.

Nevertheless, for our first few offset issues we could not avoid this. Copper half-tone plates for printing had been made from the original photographs, and the latter in many instances returned to contributors, loaned out, or mislaid. The copper half-tone is not of the slightest value to the lithographer; he can in no way use it as the basis of reproduction. All that was left to do was to strike off proofs from these copper plates, with every possible attention to detail and finished work, and to paste these proofs in our typewritten forms; but however carefully such proofs might be made, they are printed half-tones, showing a screen, and when photographed again the result must be poor. It was not until the middle of November that we got to a point where we were using material which had originated since the outbreak of the printing troubles, and where we consequently had been able to see that all original photographs were available. Then we were on clear ground; for we simply blocked out a blank space of proper size on the typed page where the illustration was to appear, and sent the photograph to the lithographer with the type matter. He then made the latter on one negative, full size; and the former on another with the appropriate reduction—the reduction, in fact, which the photo-engraver would ordinarily have made. These two negatives were transferred separately to the etched plate, so that the illustration came out as a first half-tone instead of a second one, and we got the greatly improved cuts of our later November issues.

Other magazines appeared in typewritten form—some before us because they were forced to it sooner, others after. We would emphasize that the idea was not borrowed by us—that we were one of several publications which incubated it independently. Other magazines also appeared by various processes of lithography, many of them borrowing this idea from us; but here we score the distinction of having by far the largest run of any publication which undertook this method of printing. So far as we know, we were the first to resort to lithography; the only magazine of importance to appear on the offset press; and certainly the originators of the combination of typewriter and offset printing.

A Peach With Smooth Skin and Sweet Kernel

(*Continued from page 585*)

kernels into sack lots of sweet almonds in the shell, and only the ultimate consumer can detect the sophistication by means of the bitter mid the sweet.

Darwin in all probability would never have heard, in his time, of the *nuzhapersika* (literally nut-peach) of the Persian Gulf and the Tigro-Euphrates valley, the habitat of which also ranges to the Bosporus and the Caspian. But this fruit bears out the reasoning of the philosopher. It is the connecting link, the only fruit of the peach family possessing an edible sweet-almond kernel. It has not a trace of the acridity which in the ordinary peach or plum pit recalls at once the taste of the bitter almond. At its best, fully matured, the peach halves easily and the plump pit drops out dry. The stone will be found to possess all the rugged hardness of the ordinary peach-pit; it is almost as hard to crack, in fact, as our hickories and black walnuts.

Under proper cultivation the nut-peach would have great possibilities. It means growing a delicious fruit and choice nut in one! Although known since remote ages in the orient, wild nature has there been ever left to do the growing.

The fruit is always of good appearance, with beautiful flushes of red, and a *smooth surface*, which at first glance might lead one to imagine that here was a confection rather than a real fruit. They are of exquisite bouquet and flavor—at once reminiscent of the peach, but yet different. Opening a freshly arrived case of these nut-peaches, one gets a whiff of fruity fragrance that lingers.

The wax-like surface of the nut-peach at once distinguishes it from the velvet-covered peach; and it need be peeled no more than you would think of peeling a strawberry.

The nut-peach is not the only sweet-almond fruit of the globe. There is one other—and only one other. One of the plum family has an edible nut about the size of a hazel nut. The tree grows wild from the region of the Caspian overland as far as the south of Hankow. This plum is an amber-colored one, of delectable flavor resembling luscious Muscatel raisins; hence a name for it among some American missionary workers in eastern countries is the raisin plum. It is also called the tea plum because some varieties have a unique flavor recalling the refreshing fragrance of certain high grade teas. In Asiatic bazars it retails at the equivalent of one cent per pound.

Among various foreign-fruit importers in American cities these two sweet-almoned-kerneled fruits have been on regular sale, in season, for the past half-century or more, as is attested by the fact that there was not the slightest difficulty in purchasing, in New York, the one photographed to illustrate this article. But they are little known generally because their sale is confined to the foreign colonies of the Asiatic and some of the south-European races.—*L. Lodian.*

Why Horses Are Shod

THE blacksmith shop, getting in the days when the horse was supreme a large portion of its income from horse-shoeing, is still regularly patronized by the horse owner. The town or city man working a horse steadily, believes that the horse should be given shoes. And he is largely right. The horses which by the hundred thousand run at large in the plains country, go barefoot, yet they have foot-health. It is only under the artificial conditions imposed by man that the horse requires shoes.

A good deal of this necessity for shoes arises from hard pavements and roads which the horse is worked on. But there is still another reason. The stabled horse does not get at night a foot dew bath. He needs that dew-bath. The moisture can be supplied, and sometimes is, by packing the foot each night in wet clay, a method so wasteful of labor that it is only resorted to in exceptional cases, usually when the need is acutely manifest.

To maintain healthy condition and durable texture, the horse's hoof must have moisture. This the dew-bath, enjoyed by the pastured horse throughout the night, effectively supplies. Night dew is recognized by horsemen as the best of all medicine for hoofs. Soaking in, it invigorates the whole structure. The hoof becomes much tougher, more rounded and better spread. It is not uncommon for horses which are pastured at night through the summer season to stand up under daily work without being shod. The horse which runs constantly in pasture develops sound, tough hoofs, which though lacking shoes, do not chip, break or crack.

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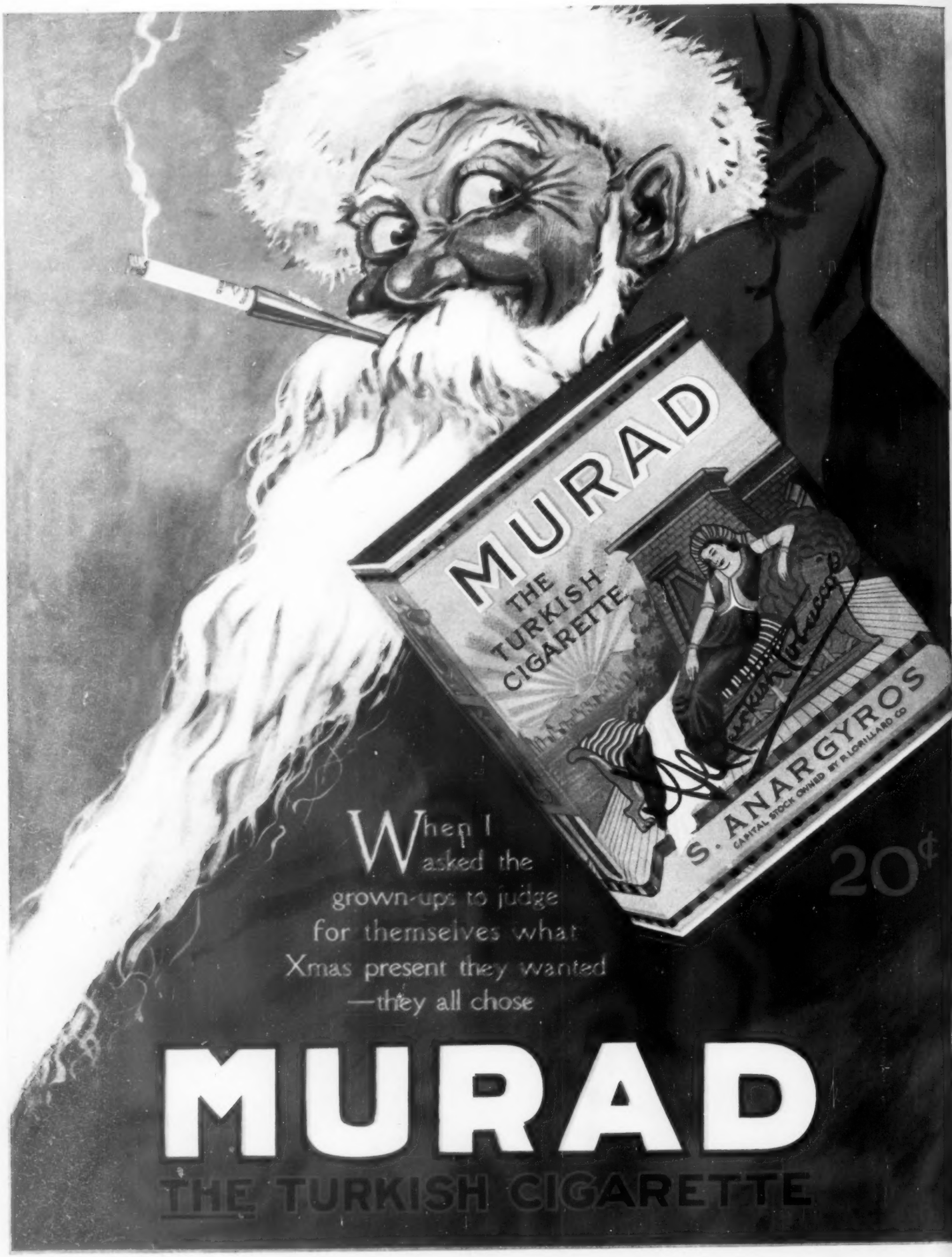
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THE TURKISH CIGARETTE
S. ANARGYROS
CAPITAL STOCK OWNED BY P. LORILLARD CO.
20¢
When I asked the grown-ups to judge for themselves what Xmas present they wanted —they all chose
MURAD
THE TURKISH CIGARETTE